Demand Access System (DAS)

Preliminary Design Review

26 - 27 October 2000

Day 1

“DAS – Next Generation Multiple Access Service”

PDR Agenda - Day 1

Program Overview	**10:00 – 10:30**	**Walt Kearns**
System Overview	**10:30 – 11:15**	**Ted Benjamin**
Requirements Analysis I	**11:15 – 12:00**	**Charlie Hammond**
	LUNCH (60 mins)	
Requirements Analysis II	**13:00 – 13:45**	**Charlie Hammond**
System I&T and Verification	**13:45 – 14:00**	**Charlie Hammond**
	BREAK (15 mins)	
Hardware Design I	**14:15 – 15:15**	**Gene McLeod**
	BREAK (15 mins)	
Hardware Design II	**15:30 – 16:30**	**Gene McLeod**

PDR Agenda - Day 2

Software Design I	**10:00 – 12:00**	**Bob Smarrelli**
	LUNCH (60 mins)	
Software Design II	**13:00 – 14:00**	**Bob Smarrelli**
ITT Summary	**14:00 – 14:15**	**Walt Kearns**
	BREAK (15 mins)	
CSOC Review	**14:30 – 15:30**	
	BREAK (15 mins)	
Government Caucus	**15:30 – 16:00**	
RFA Review	**16:00 – 16:30**	

ITT PDR Agenda

- ❑ **Program Overview**
- ➔ **System Overview**
- ❑ **Requirements Analysis**
- ❑ **System I&T and Verification**
- ❑ **Hardware Design**
- ❑ **Software Design**
- ❑ **Summary**

SE Guidelines and Objectives for PDR

- **PDR Guidelines provided in DAS PMP and STDN SPEC-4**
  - Present an analysis of requirements
  - Demonstrate that the design meets the requirements
  - Provide a plan for accomplishing the selected design

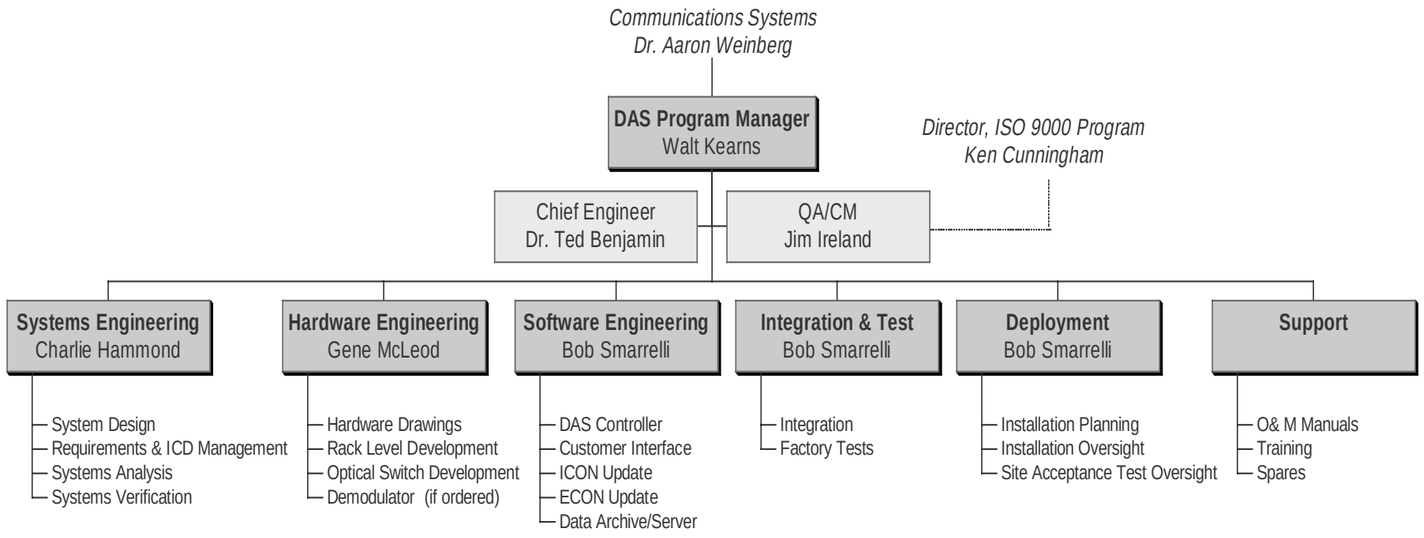
- **Tailor guidelines to fit the DAS Program; key considerations include:**
  - Beamformer designed under previous effort and available as COTS
  - Extensive use of other COTS hardware and software components to reduce costs
  - Draft Acceptance Test Plan due at CDR
  - Verification testing scheduled to commence on 9-25-2001

Program Concept

- DAS is intended to capitalize on the ITT-provisioned Third Generation Beamforming System (TGBFS) by significantly expanding TDRSS MA Services through *adding demodulation, switching, formatting and storage, and distribution capabilities*. ITT will:
  - Use COTS TGBFS IBUGs to provide core beamforming capabilities
  - Modify the software of a COTS ITT programmable MA demodulator to handle DAS MA-return capabilities.
  - Add COTS switching between EMCs and Beamformers, and between Beamformers and Demodulators
  - Add data formatting and COTS archiving capabilities
  - Modify existing TGBFS controllers to interface with DAS, add demodulator controller and system controller using COTS processors
  - Use the SWSI system for customer request and status exchange; and the NISN IONET for customer return telemetry data transport
- DAS is primarily a semi-custom COTS integration effort with extensive software development to achieve demand

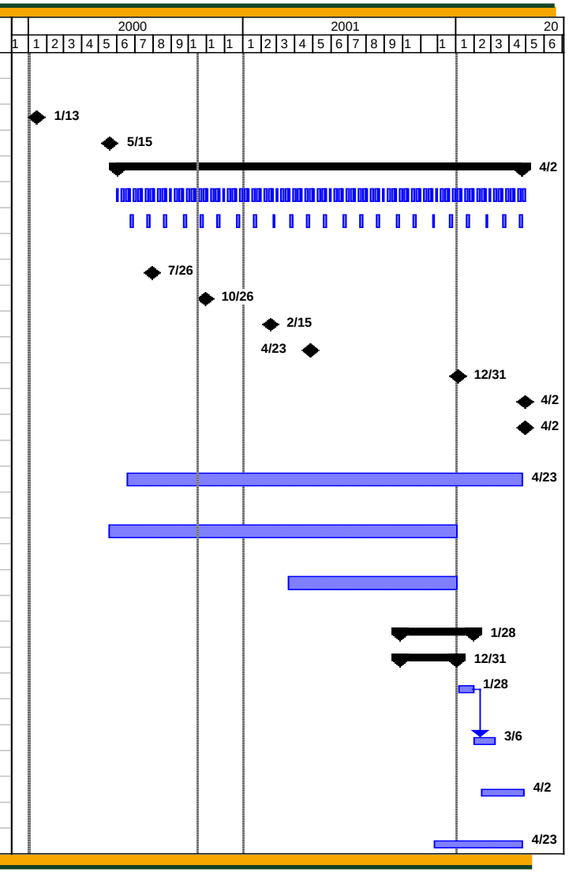
Software is the largest development effort.

ITT DAS Organization



Overall Schedule

ID	Task Name	Start
1	**Summary Schedule**	Mon 1/3/00
2		
3	**NASA GSFC Start**	Thu 1/13/00
4	**ITT Industries Start**	Mon 5/15/00
5	**Status Meetings**	**Mon 5/29/00**
6	**Weekly Status Review**	**Mon 5/29/00**
107	**Monthly Status Review**	**Wed 6/21/00**
131	**Major Milestones**	**Wed 7/26/00**
132	System Requirements Review	Wed 7/26/00
133	Preliminary Design Review	Thu 10/26/00
134	Critical Design Review	Thu 2/15/01
135	Test Readiness Review	Mon 4/23/01
136	Development Complete	Mon 12/31/01
137	Operations Readiness Review	Thu 4/25/02
138	Operations Capability	Thu 4/25/02
139		
140	**CSOC Site Planning and Verification**	Thu 6/15/00
141		
142	**Design and Development**	Mon 5/15/00
143		
144	**System Integration**	Mon 3/19/01
145		
146	**System Testing**	**Tue 9/25/01**
147	System Design/Performance Verification Testing (WSC & Factory)	**Tue 9/25/01**
150	Factory Verification Testing	Thu 1/3/02
151		
152	**Shipping and Installation**	Wed 1/30/02
153		
154	**Site Testing and Training**	Tue 2/12/02
155		
156	**Site Transition to Completion**	Fri 11/23/01



ITT Document Delivery Status

DRL No.	Deliverable	Document Number	Current Revision	Estimated Delivery Date	Level of CM Control	Type of File
1	Product Management Plan	028-600000	Rev. -	7/24/2000 (A)	CR	MS Word
2,3	QA/CM Plan	QM-01	Rev. B	7/24/2000 (A)	CA	Acrobat
4	Schedule	-	Rev. -	9/13/2000 (A)	N/A	MS Project
6	Detailed System/Subsystem Specification	033-600004	Rev. -	11/15/00 (E) Final CDR	CR	MS Word
7	Internal Interface Control Document	014-600006	Rev. -	10/25/00 (A) Final CDR	CR	MS Word
8	Software Design Documentation	Various		Draft CDR + 90 days Final ORR - 30 days		MS Word
9	Hardware Design Drawings	Various		Draft CDR + 90 days Final ORR - 30 days		TBD
10	Site Preparation and Installation Plan	028-600031		Draft TRR -60 days Final TRR -30 days		MS Word
11	Acceptance Test Plan & Procedures			-		MS Word
	- System Test Plan	TBD		Draft CDR Final CDR + 30 Days		
	- Subsystem (CI) Test Plan	TBD		Draft CDR + 60 days Final CDR + 90 days		
	- Test Procedures	TBD		Draft CDR + 150 days Final CDR + 210 days		

ITT Document Delivery Status - 2

DRL No.	Deliverable	Document Number	Current Revision	Estimated Delivery Date	Level of CM Control	Type of File
12	Performance Verification Matrix	024-600007	Rev. -	8/25/2000 (A)	CR	Acrobat
13	Acceptance Test Report	035-600008		15 Days after Test Final at ORR		MS Word
14	Inspection & Analysis Report	035-600009		15 Days after Test Final at ORR		MS Word
16	RMA Analysis Report	035-600010	Rev. -	10/25/00 (A) Final CDR	CR	MS Word
17	Operations and Maintenance Manual	015-600012		Draft TRR - 30 days Final at TRR		MS Word
	Operations and Maintenance Manual for the Demodulation Group Unit	015-147007		Draft TRR - 30 days Final at TRR		
18	Training Plan and Materials			-		TBD
	- Training Plan	TBD		Draft TRR - 30 days Final at TRR		
	- Training Materials	TBD		Draft TRR - 30 days Final at TRR		
19	Integrated Logistics Support Plan	028-600011	Rev. -	10/25/00 (A) Final CDR	CR	MS Word

CA Change Authorization needed prior to changing document
CR Change Record make to reflect changes in docoument
N/A Controlled document, without formal change process

Key Requirements Concerns

- **Security**
  - Goal is minimum design impact
  - Revised requirement will apply WSC, SWSI and NISN IONet Security Plans to DAS
  - DAS will be designated a Mission (MSN) resource within the WSC, SWSI and NISN IONet security envelop
    - The SN is a MSN resource
    - DAS will be an extension of the SN
  - SW Design impact assessment in-progress

- **Data Formatting**
  - RFA 450/145-01 replaces CCSDS SLE with requirement to “mimic current WDISC telemetry formats”
  - NASA to define formats by 11/30/00
  - SW Design impact assessment in-progress; but need formats to complete

Key Requirements Concerns (cont'd)

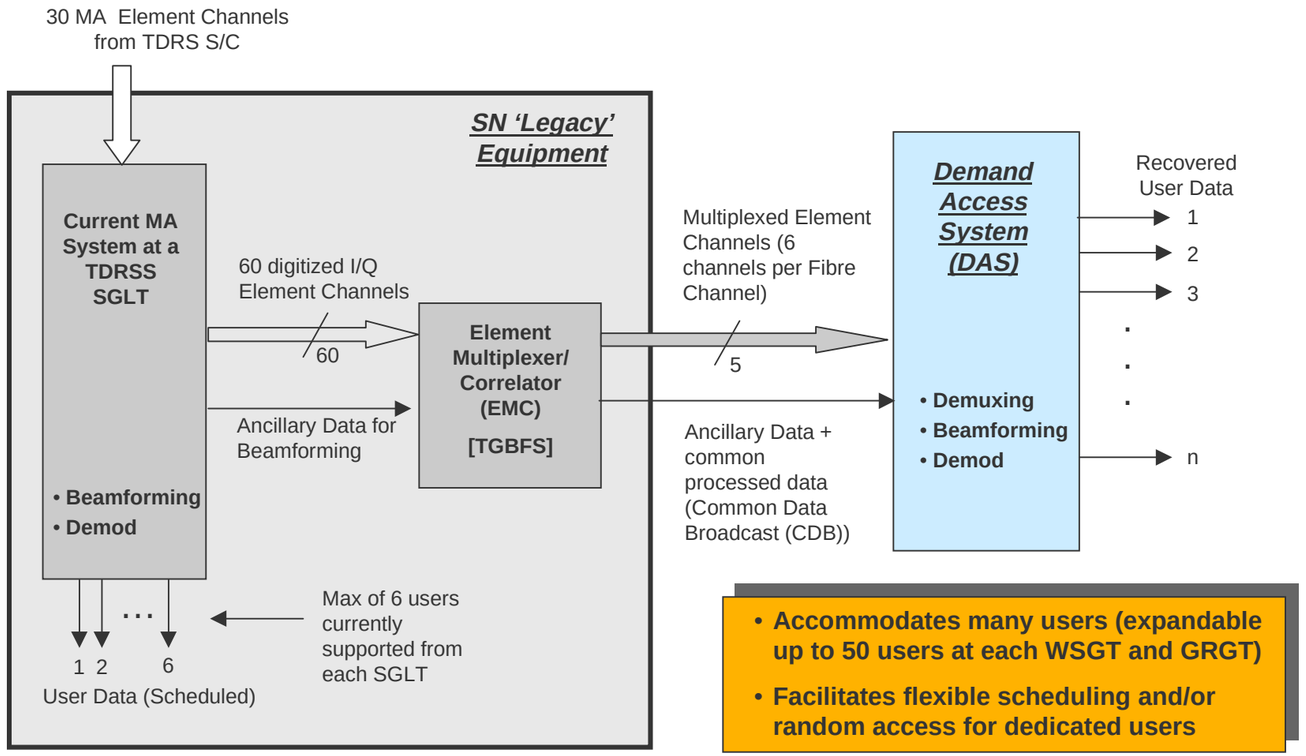
- **SWSI as Customer Interface**
  - Original DAS concept envisioned direct DAS-Customer Interface
  - DAS SRD update requires use of SWSI as the Customer Interface
  - Need to develop new DAS-SWSI ICD
  - SW Design assessment in-progress

- **DAS SRD / Receiver RFI differences**
  - DAS demodulator ordered in August 2000 based on specifications to allow production as COTS items
  - Differences between the DAS SRD & RFI demodulator specification are being reconciled
  - No issues anticipated

PDR Agenda

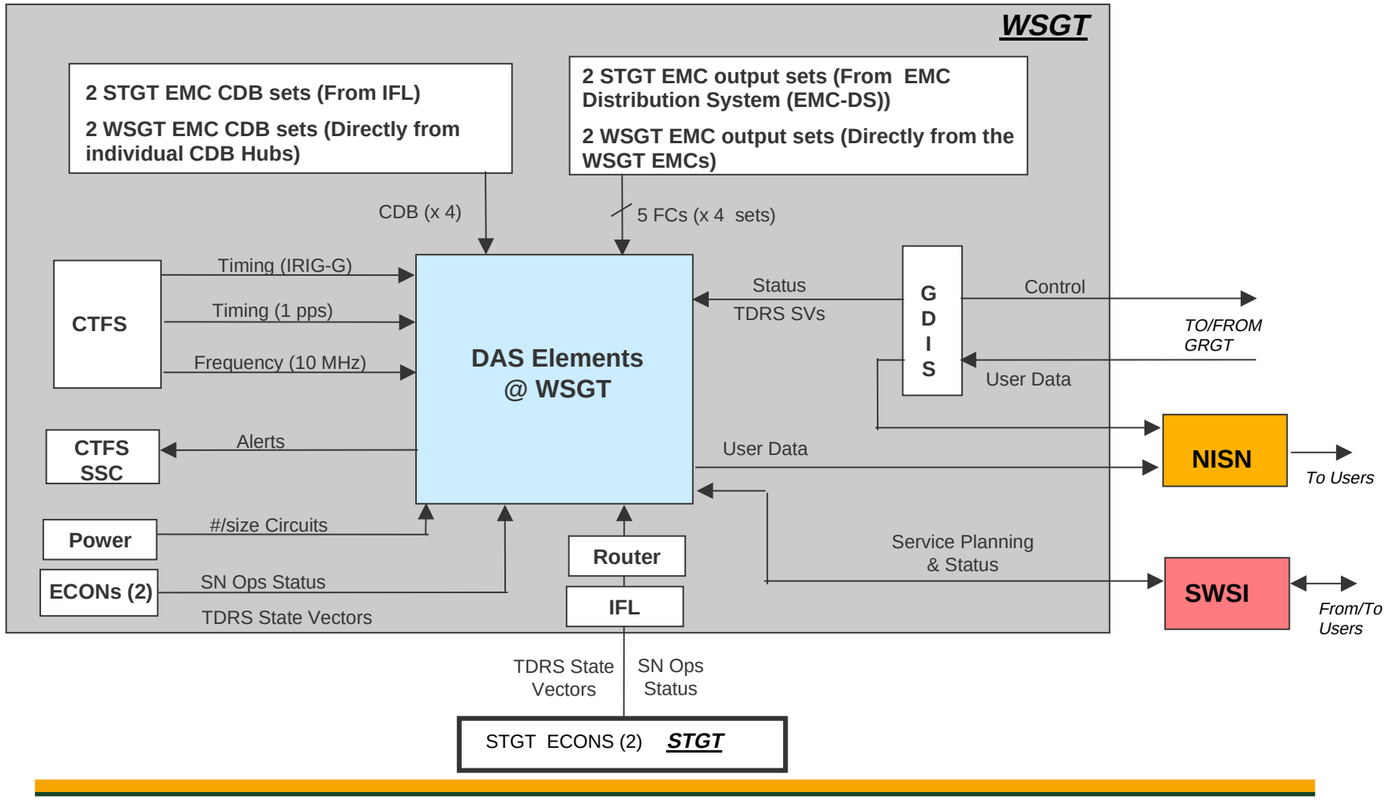
- **Program Overview**
- **System Overview**
  - System Concept
  - Interfaces
  - Architecture
  - CI Decomposition
  - Implementation Approach
  - Ops Concept Considerations
- **Requirements Analysis**
- **System I&T and Verification**
- **Hardware Design**
- **Software Design**
- **Summary**

High-Level DAS Concept



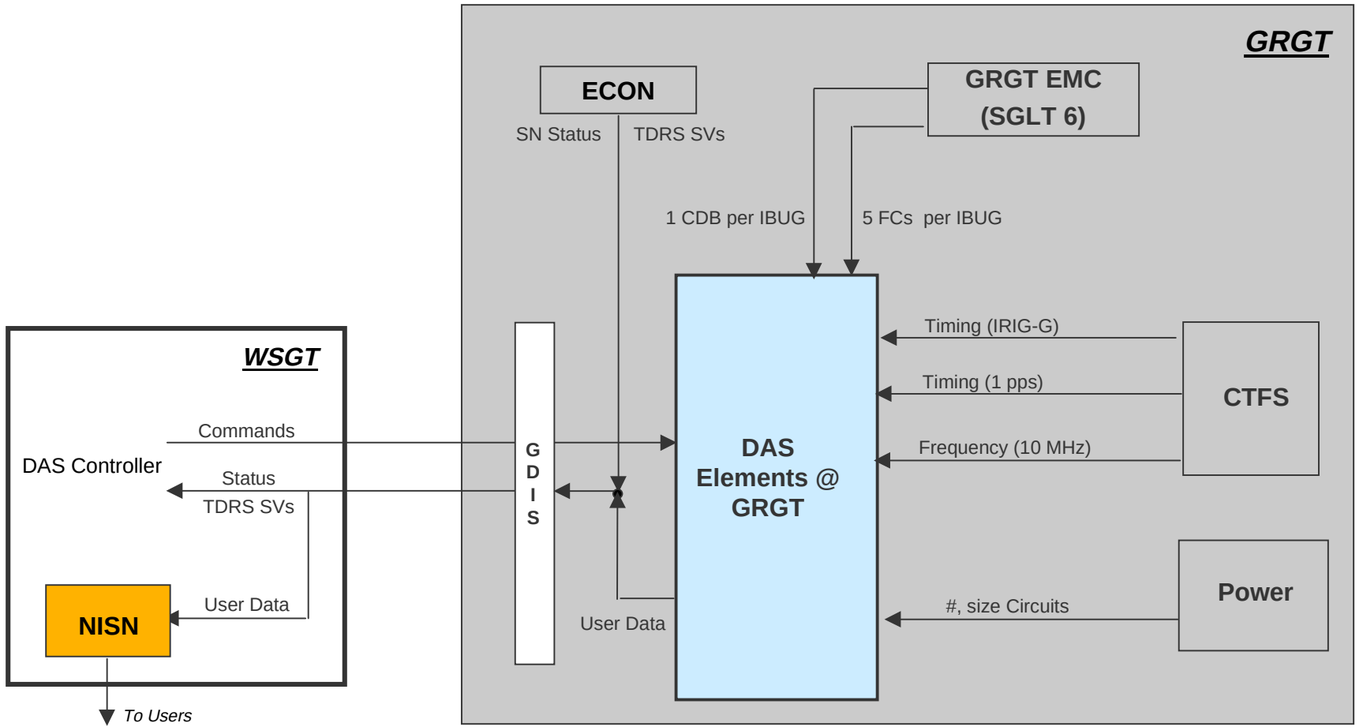
External DAS Interfaces @ WSGT

(Documented in 3 External ICDs)

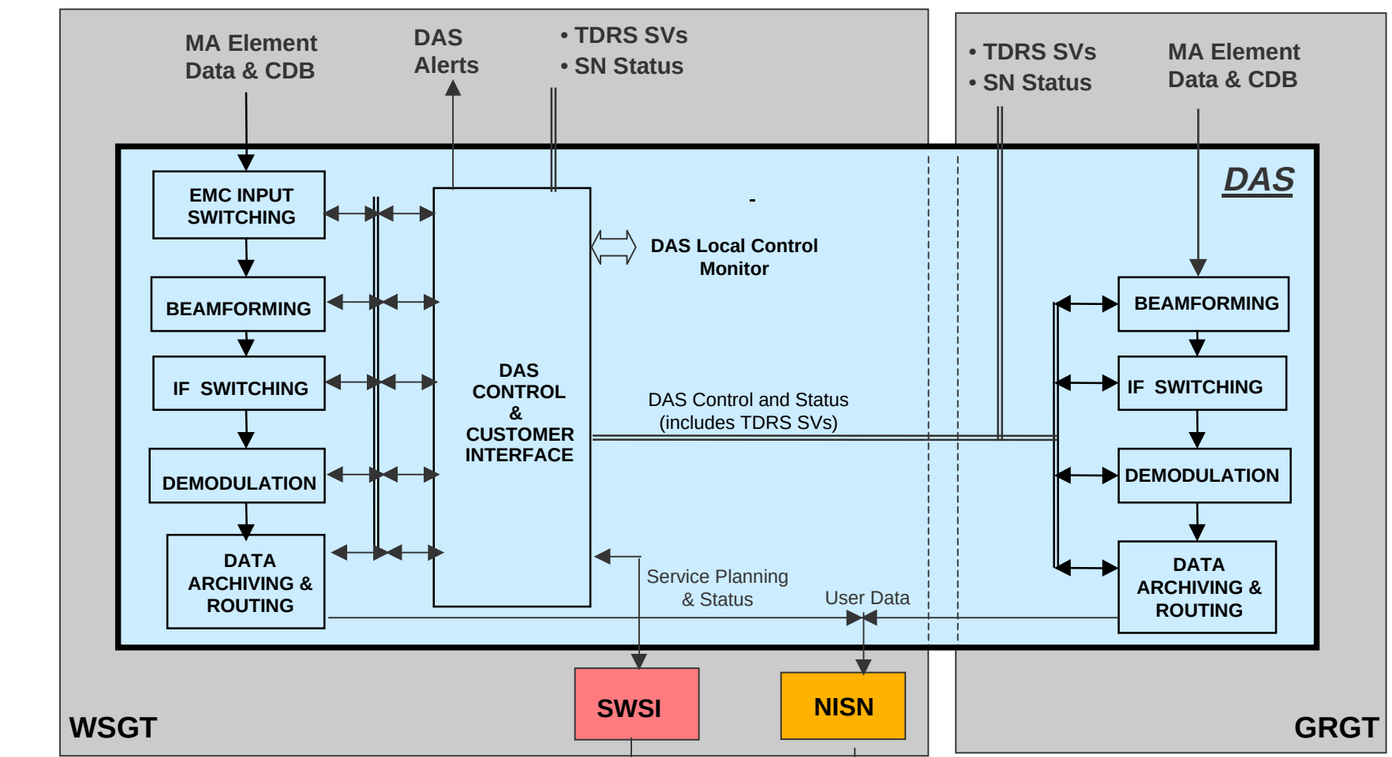


External DAS Interfaces @ GRGT

(Documented in Legacy WSC-DAS ICD)

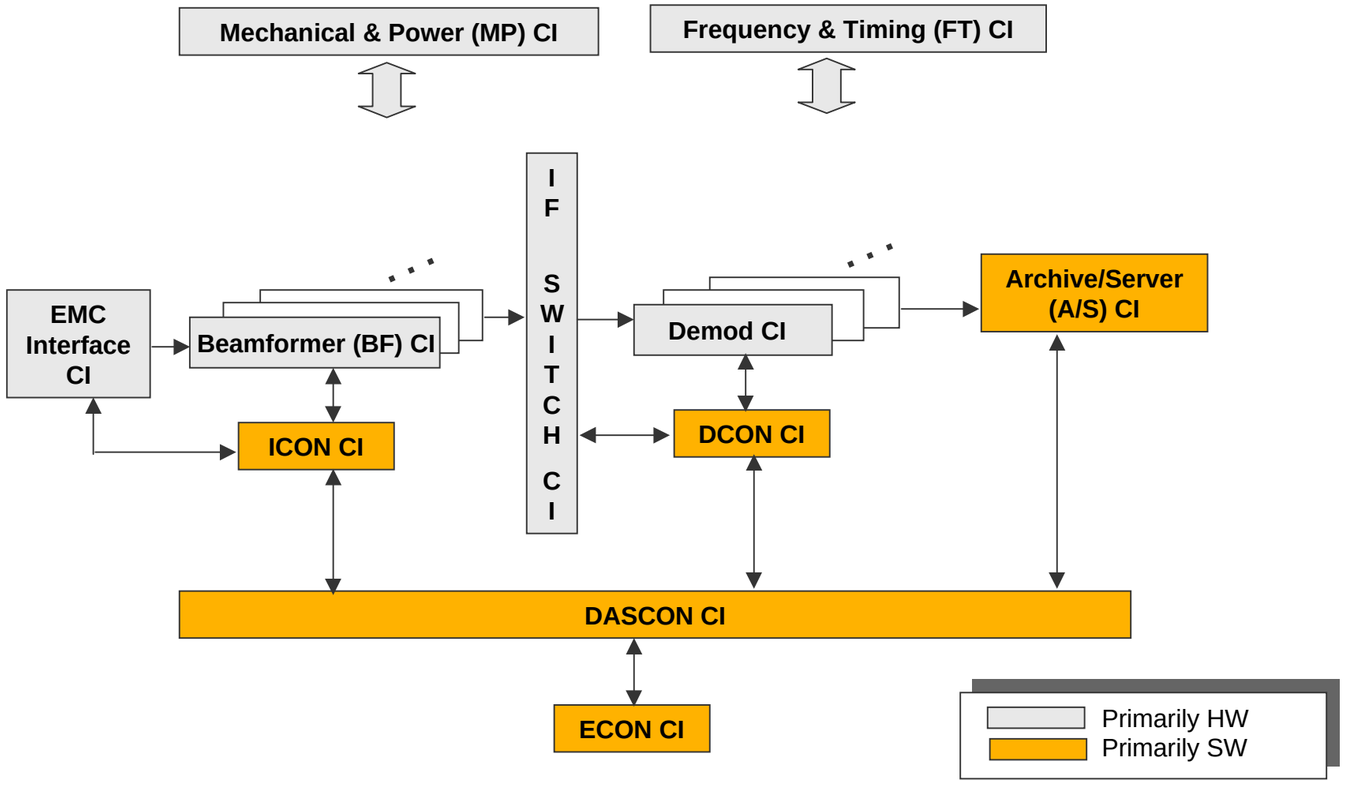


Functional Architecture



DAS CI Decomposition (11 CIs)

6 HWCIs and 5 SWCIs



Design Approach Overview

Major Signal Processing Elements

OPTICAL SWITCHING

- Semi-COTS; Chassis of multiple (2) COTS Systran NTSs
- NTS ports cards are short-λ
- Use of In-chassis CP; Custom Chassis based on IBUG chassis design

BEAMFORMING

- COTS; TGBFS IBUGs
- Ensure design accommodates growth in number of IBUGs
- Ethernet control to In-Chassis CP

IF SWITCHING

- COTS; Universal Switching S6400C [non-blocking (64 x 64)]
- Populated with 8 ports cards each providing 8 inputs/8 outputs
- RS-232 control

DEMODULATION

- Custom Development leveraging existing ITT receiver technology
- Multiple demods per chassis
- Hardware essentially unchanged from existing ITT receiver hardware design
- Major development is the embedded SW reflecting new DAS signal processing

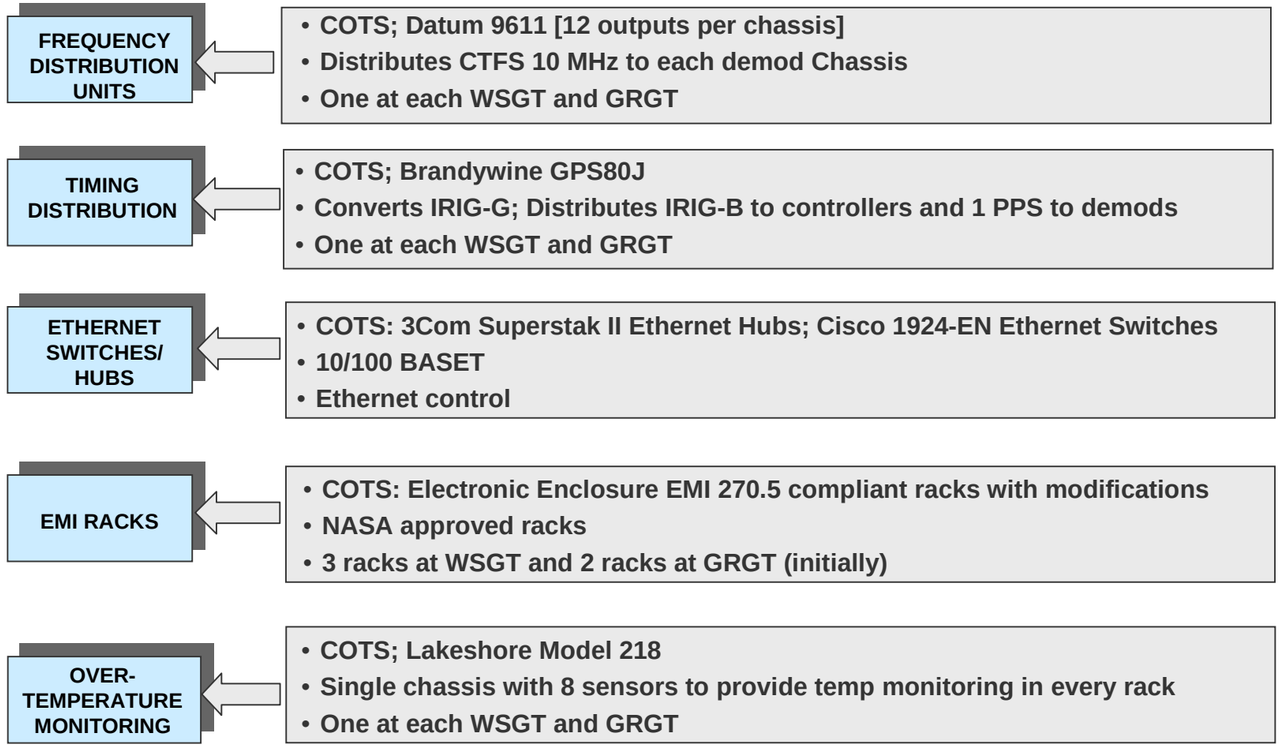
• DASCON
• ARCHIVE/SERVER

- COTS Hardware
- Primarily Custom Software
- DASCON represents most extensive development effort in DAS

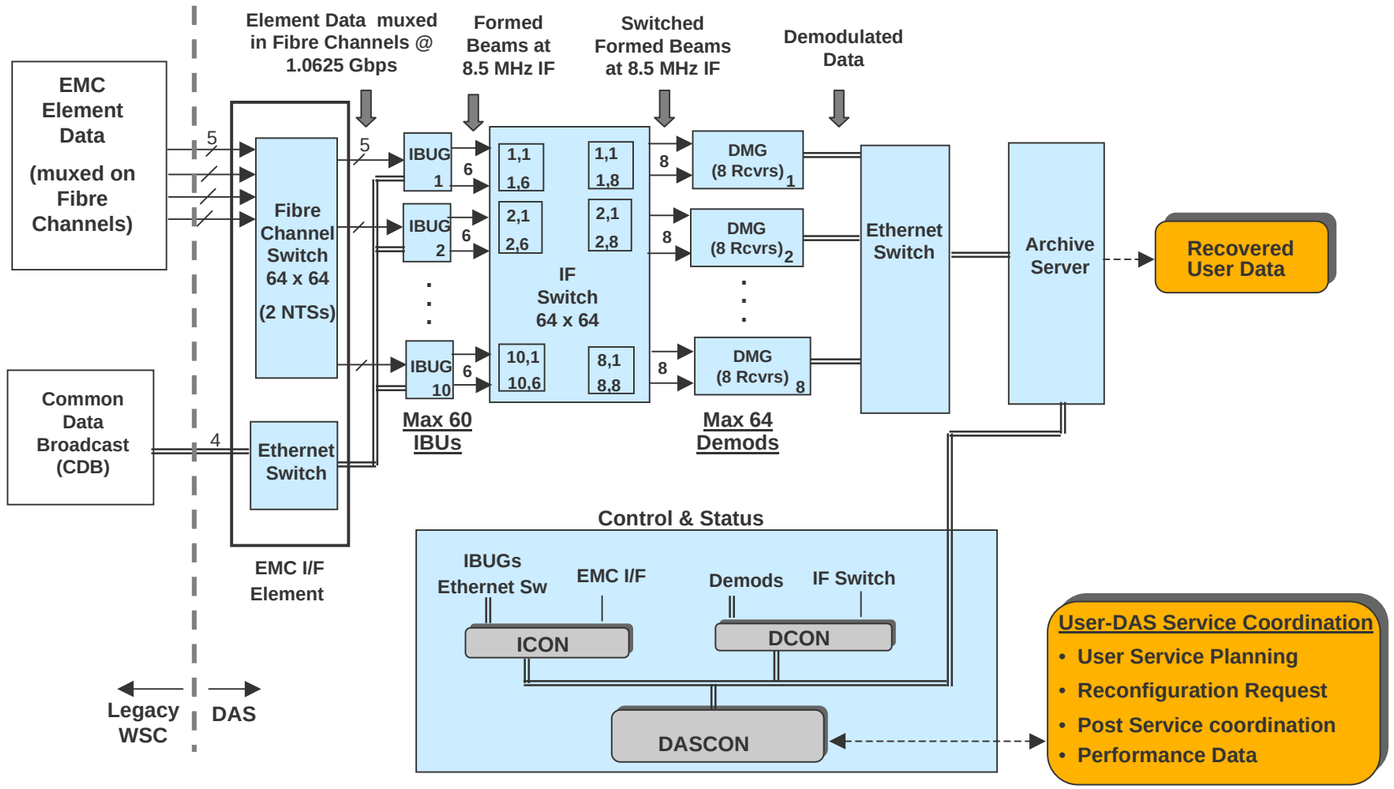
Custom Development primarily for: DASCON SW, Archive/Server SW and Demod Embedded SW

Design Approach Overview

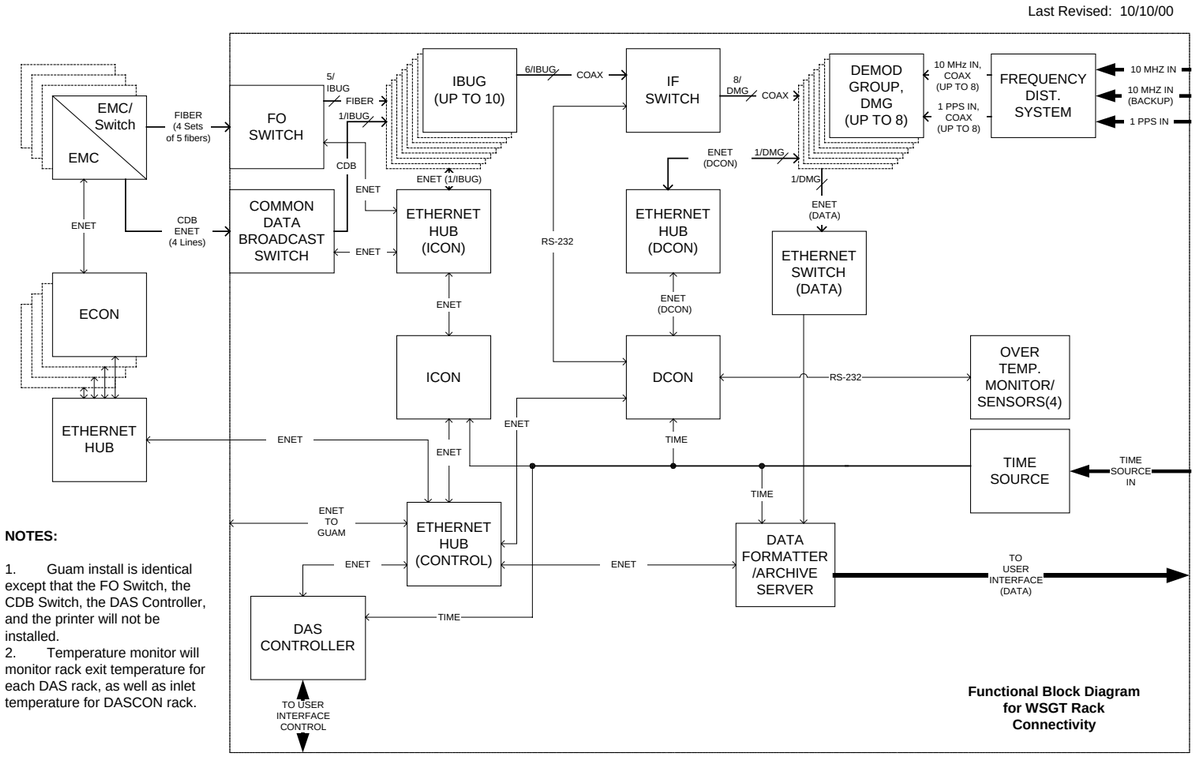
Supporting Elements (All COTS)



‘Signal Processing’ Architecture (WSGT)



DAS System Block Diagram and Interconnects



NOTES:

1. Guam install is identical except that the FO Switch, the CDB Switch, the DAS Controller, and the printer will not be installed.
2. Temperature monitor will monitor rack exit temperature for each DAS rack, as well as inlet temperature for DASCON rack.

J:\EVERYONE\DAS PROGRAM\PERSONAL FOLDERS\STEVE J\DASFBD101000.VSD

Adding IBUGs and DMGs to Basic Infrastructure

- **IBUG and DMG chassis are ‘plug and play’ up to:**
  - 8 DMGs (Demod chassis) at each WSGT and GRGT
  - 10 IBUGs at WSGT; 10 IBUGs at GRGT but each requires a separate EMC output set

- **Controllers automatically report presence of operational IBUGs and DMGs**

- **No need for operator to update database**

- **ICONs, DCONs, IBUGs and DMGs have pre-defined IP addresses that facilitate ‘plug and play’ operation**
  - These IP addresses can be altered from the IBUG and DMG FPDs and from the ICON and DCON GUIs

GUIs for Operations Support

Local Control and Monitor (LCM)

LCM consists of three GUIs on three separate monitors:

1. DASCON

- Directly controls Archive/Server
- Interfaces with ICON and DCON for status/control of DAS equipment
- Provides GUI for overall DAS Operations

2. ICON

- Directly controls IBUGs and Optical Switch
- Interfaces with DASCON
- Provides fault isolation at and below the LRU level

3. DCON

- Directly controls DMGs and IF Switch
- Interfaces with DASCON
- Provides fault isolation at the LRU level
- DMG Front Panel Display (FPD) supports fault isolation below the LRU level

User Scheduling

DASCON

- **Active schedule is 96 hours; updated daily**
  - Users are informed of service 96 hours prior to requested scheduled start time
- **Dedicated user requests are allocated to dedicated resources and hence are guaranteed service**
- **Non-dedicated user requests are then assigned within remaining resources**
  - Queued in ascending order on a ‘first-come/first serve’ basis and updated daily
  - Initially assigned resources on non-dedicated resources before trying to schedule time on dedicated resources (to minimize likelihood of being bumped)
  - If a dedicated user “bumps” a scheduled non-dedicated user, the non-dedicated user is notified
  - Implicit here is that NASA buys sufficient “non-dedicated” resources to meet a TBD probability of obtaining service

User Data Handling and Archiving

Archive/Server

- **DAS provides data in real time during service**

- **DAS also archives user data, if requested**
  - DAS routes user data upon user request (i.e., no FTP access by users) at a rate dependent on the bandwidth that NISN and IONET can support

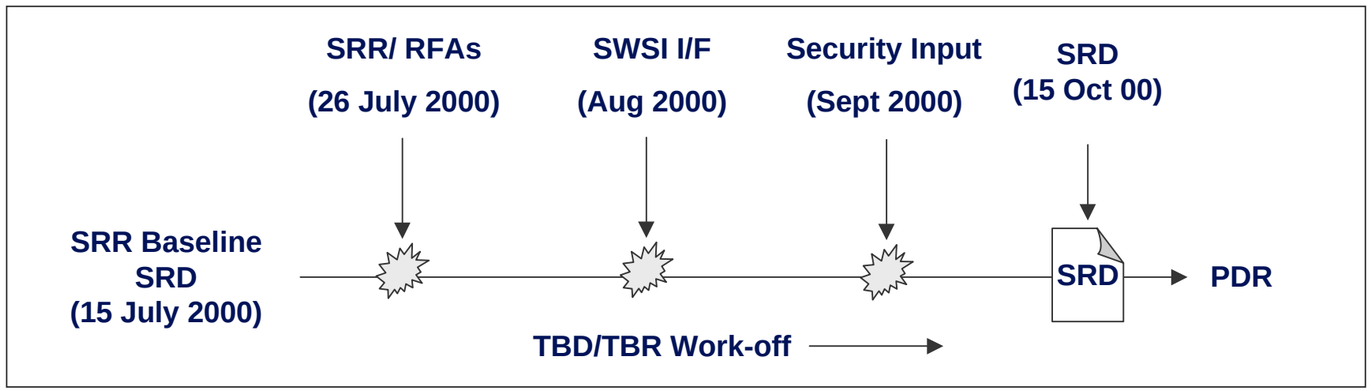
- **Users request data archiving duration 'Customer Setup' Session**
  - Service level agreements may address the amount and length of time that user data is archived
  - DAS automatically removes data when time expires
  - Users are notified when their data storage passes the "next" increment as set in the user profile (e.g. for 10 MB increment, user notified every time his storage hits 10 MB, 20 MB, 30 MB, etc.)
  - DAS attempts to reserve > 4 GB unallocated storage for upcoming user services; this implies a nominal user storage availability of ~3 GB with overhead and margin (> SRD 100 MB reqmt)
  - @ 150 Kbps,1 hour of data → 67.5 MB; e.g. @ 3 GB → 44 hours of data collection @150 Kbps

- **DAS generates an alert when the RAID is 50%, 80%, 90% full, so DAS Administrator can take action**

PDR Agenda

- **Program Overview**
- **System Overview**
- **Requirements Analysis**
  - Requirements Baseline
  - CI Interfaces & Requirements
  - Critical Performance Requirements
  - RMA
  - FMEA and Safety
  - ILSP
- **System I&T and Verification**
- **Hardware Design**
- **Software Design**
- **Summary**

Factors Affecting DAS Requirements



- **SRD (dated 15 July 2000) is the SRR baseline**
  - Most TBDs and TBRs have been resolved
  - Issues noted above have modified some requirements, with more to be defined
- **Updated SRD (15 October 2000) is now the “original”**
- **ITT’s Preliminary Design reflects the 15 October SRD**
  - As noted on the next slide, some changes are not yet fully incorporated in our current design

Design versus 15 Oct SRD

Differences between Preliminary Design and new SRD

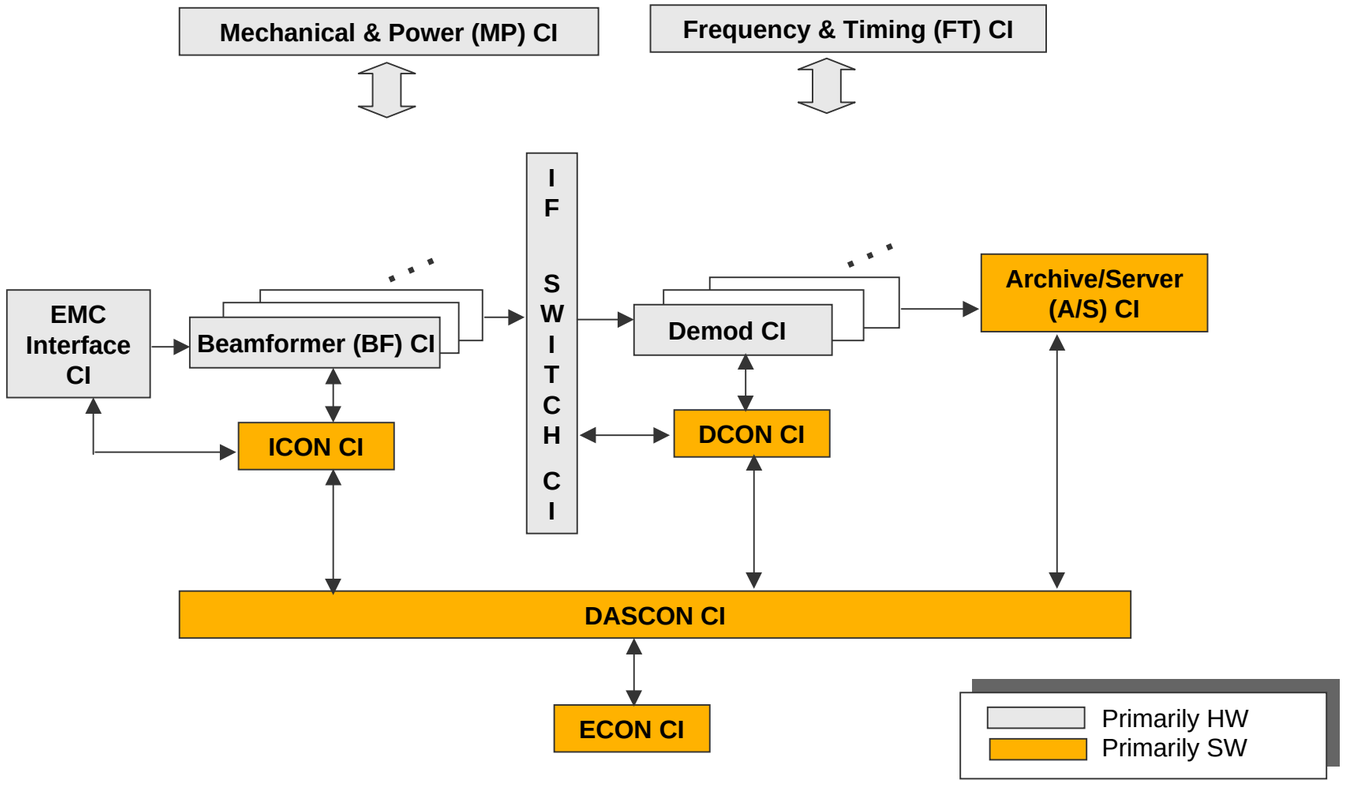
Requirement Title	Status/Resolution	Design Impact/Accommodation
Bandwidth Management of NISN pipe for return data	Anticipated additional requirement in next SRD update	Design does not yet address this requirement; impacts Software. Design impact assessment in progress
OPS Alerts	SRR RFA 144-4 requires adding "smart alerts" with Go/No-Go light	Design can accommodate; Impacts Software. Design impact assessment in progress
Security	Recent developments indicate that security requirements will be governed by WSC, NISN and SWSI security plans	Design does not yet address this requirement; Impacts Software. Design impact assessment in progress
DAS/SWSI Requirements	Anticipated additional requirements in next SRD update; New ICD required to define requirement	Design does not yet address this requirement; Impacts Software. ITT is participating in DAS/SWSI Working Group. Design impact to be detailed as ICD developed
Replacement of CCSDS SLE with WDISC formatting requirements	Detailed requirements not yet provided; New ICD required	Current Design does not yet address this requirement; Impacts Software. Design impact assessment will be initiated after receipt of requirements 11/30/00

SE Document Status

- **System/CI Specifications (DID 6)**
  - Completed DAS System Specification Draft
  - Completed HW and SW CI Specification Drafts
- **Internal ICD (DID 7)**
  - Completed Internal ICD Draft
- **PVM (DID 12)**
  - PVM populated with SRD requirements and preliminary test methodology
  - Being updated to reflect requirement changes and revised test methodologies
- **RMA Analysis Report (DID 16)**
  - Completed Draft RMA Assessment and FMEA
- **ILS Plan (DID 19)**
  - Completed Draft ILS Plan

DAS CI Decomposition (11 CIs)

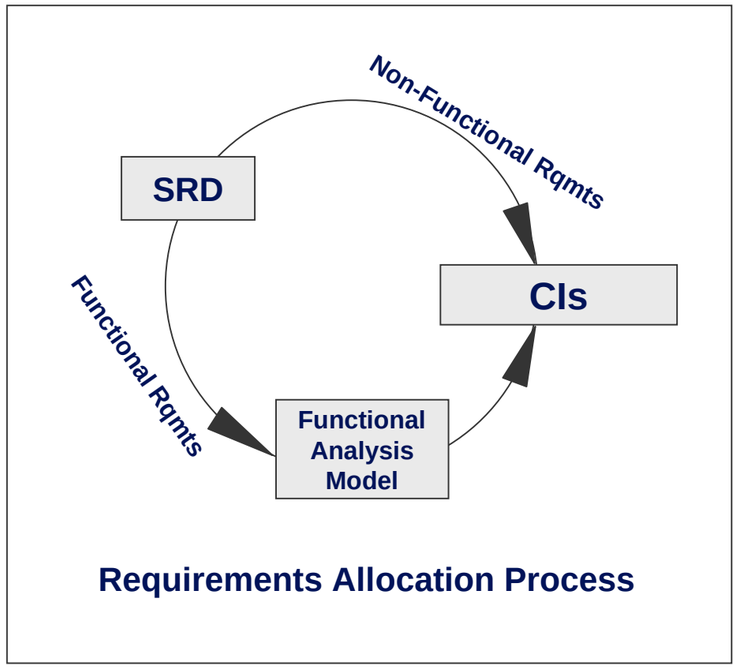
6 HWCIs and 5 SWCIs



Requirements Analysis

SRD Allocation

- **SRD Requirements (15 July 2000)**
  - 146 Functional
  - 137 Performance
  - 2 Reliability
  - 6 Maintainability
  - 4 Availability
  - 5 Environmental
  - 14 Construction
  - 10 Installation
  - 13 Maintenance
  - 8 ILS
  - 4 Expansion
  - 23 Training
  - TBD Security (under review)

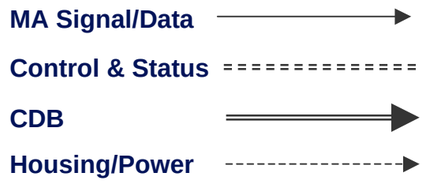


Requirements Allocation Process

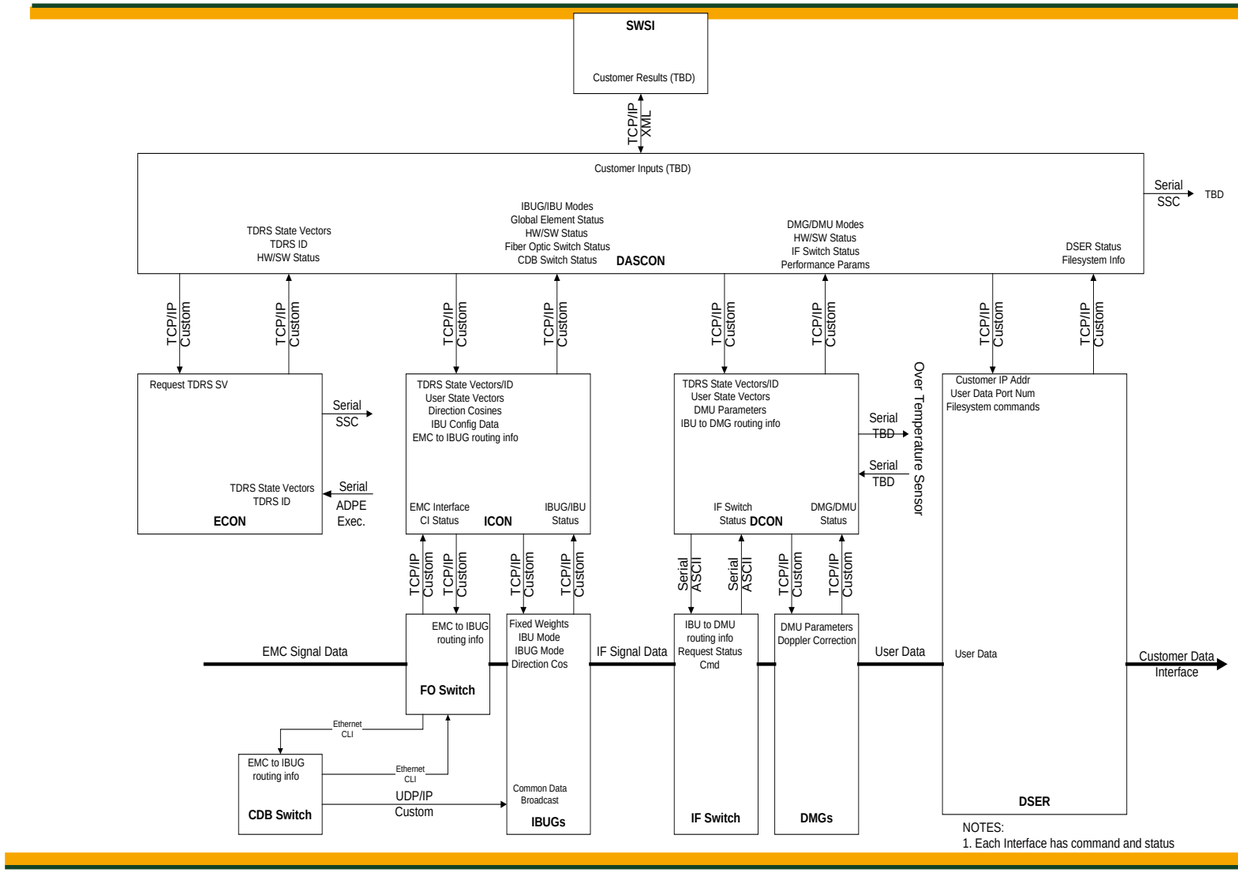
CI Interfaces and Key Requirements

- The following slides highlight CI interfaces and requirement allocations
- All requirements have been successfully allocated to CIs
- Currently, there are no issues

The following notation has been adopted for the individual CI Interface Descriptions:

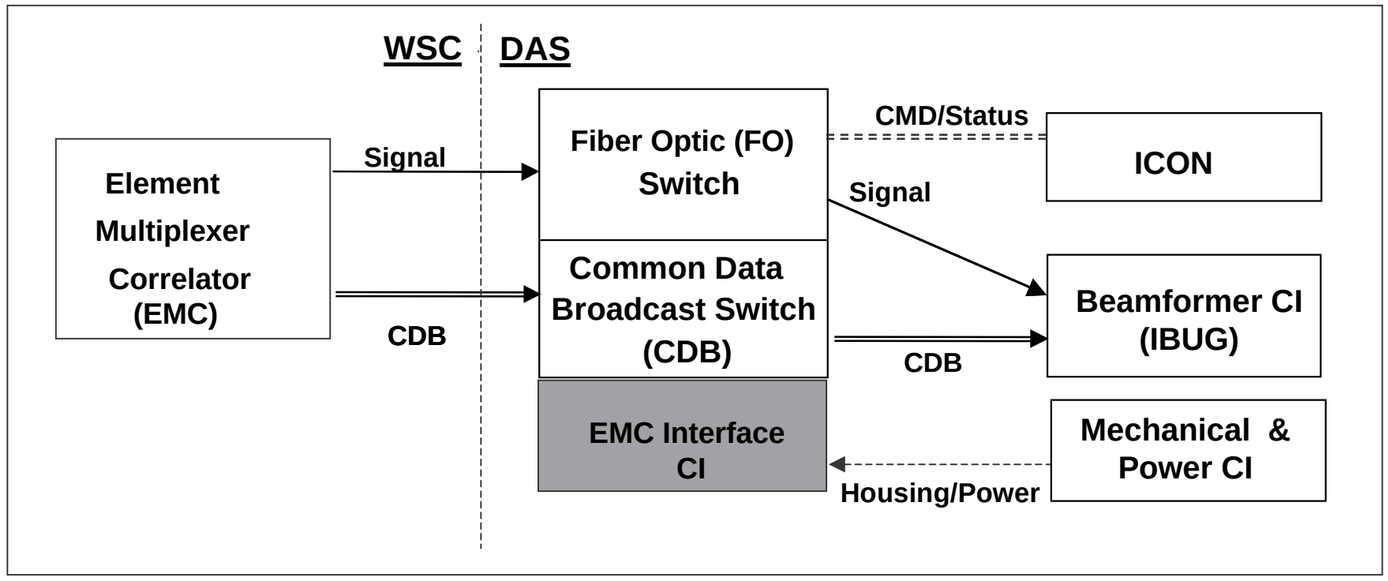


DAS Interface Overview



EMC Interface CI

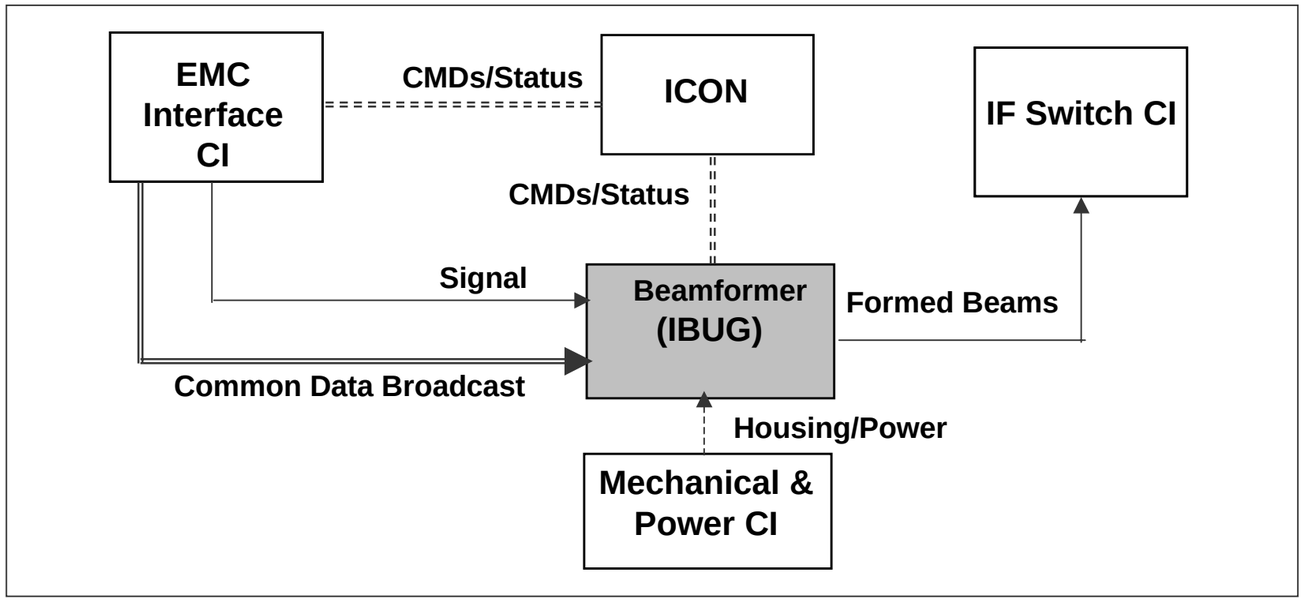
Interfaces and Key Requirements



- **EMC Interface CI connects EMC outputs to appropriate IBUGs**
  - Provides one-to-one, one-to-many connectivity at the IBUG level
  - Provides flexibility in supporting TDRS constellation

Beamformer (IBUG) CI

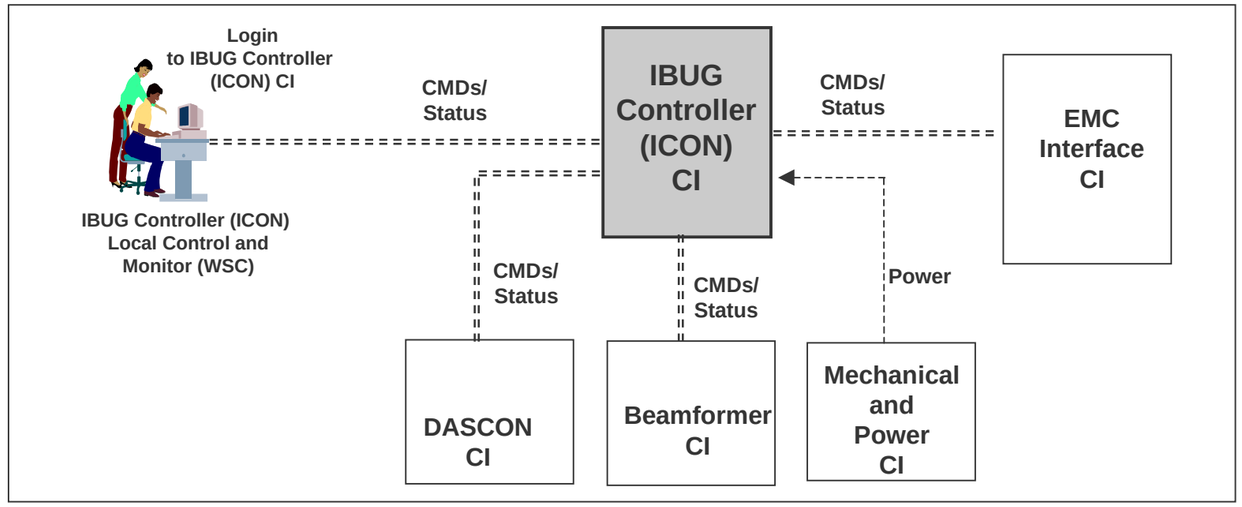
Interfaces and Key Requirements



- All requirements consistent with COTS TGBFS IBUG

IBUG Controller (ICON) CI

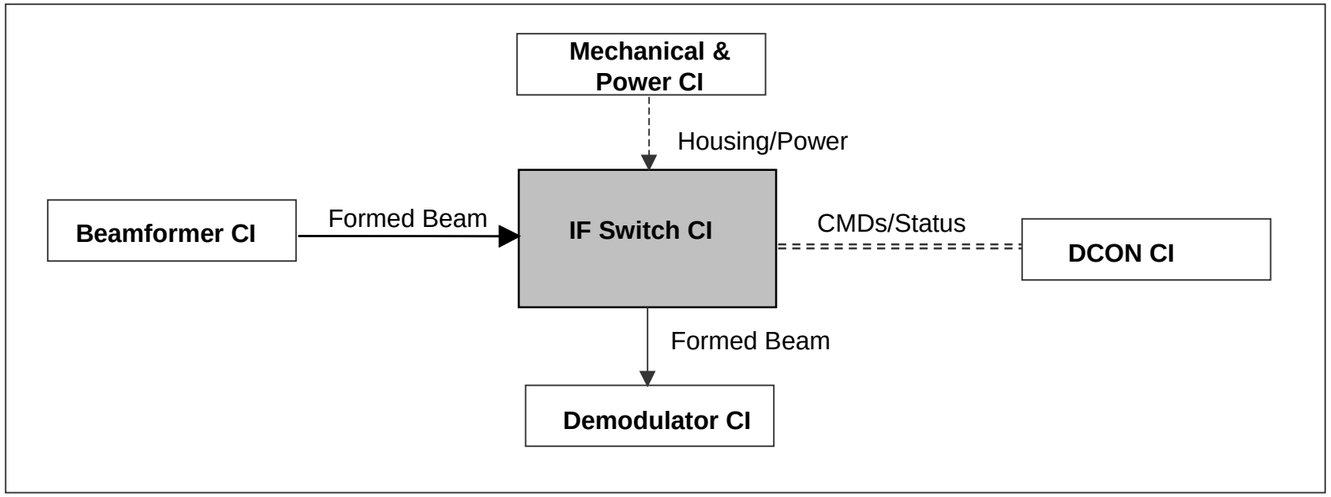
Interfaces and Key Requirements



- Provide an operational interface to monitor, coordinate, control, and report the performance of IBUGs, EMC Interface, and ICON components
- Propagate TDRS and Customer state vectors from the DASCON to generate Direction Cosines for beamforming
- Represents an upgrade to existing software

IF Switch CI

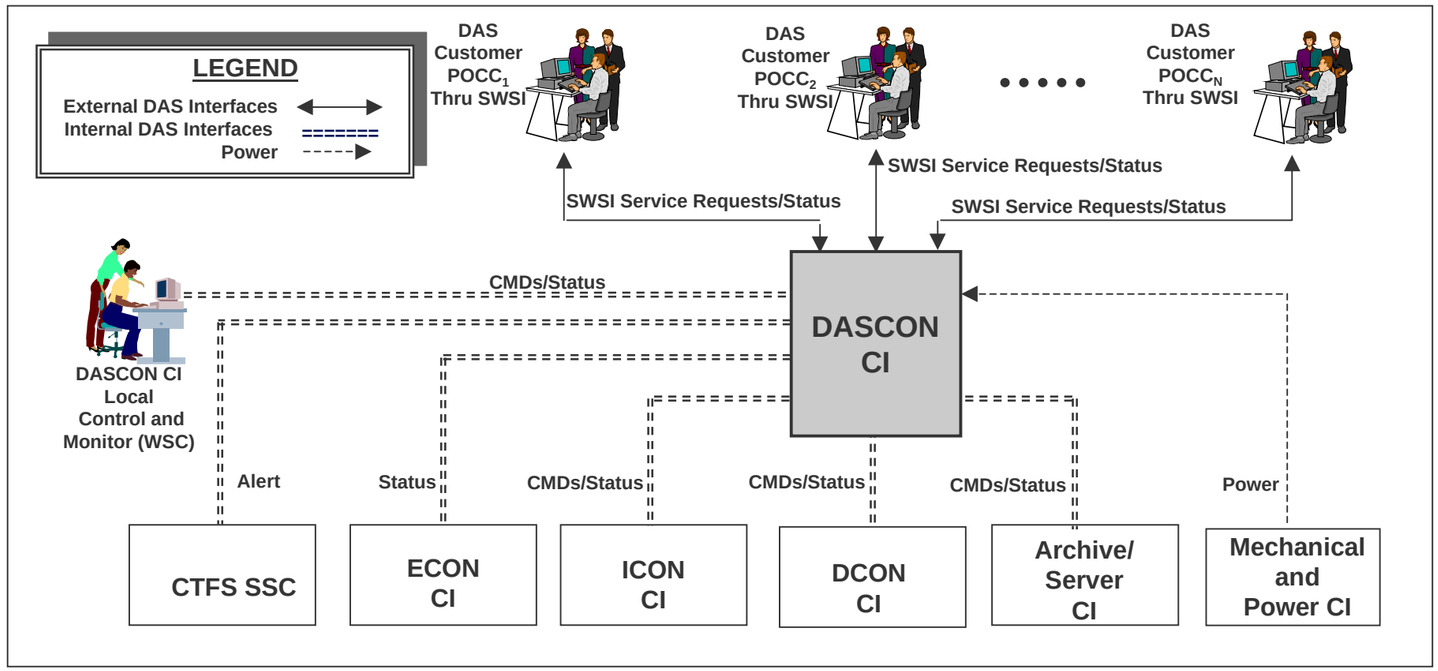
Interfaces and Key Requirements



- **IF Switch CI switches any IBU to any of at least 16 pre-designated receivers**
  - One-to-one; one-to-many connectivity
- **The IF Switch accepts requests from and provides reports to the DCON**

DASCON CI

Interfaces



DASCON CI

Key Requirements

- **Provide customers with a DAS interface to obtain service planning information and to enter service requests through SWSI**
- **Propagate user and TDRS state vector data coupled with DAS resource availability data to process DAS Customer service requests**
- **Distribute internal DAS service data to equipment controllers to support DAS Customer services at the requested times**
  - Send service specifications to ICON and DCON CIs
  - Provide direct control of the Data Format/Archive Server CI for return data distribution and archiving
- **Provide WSC personnel with overall DAS status and control via the DASCON CI GUIs**

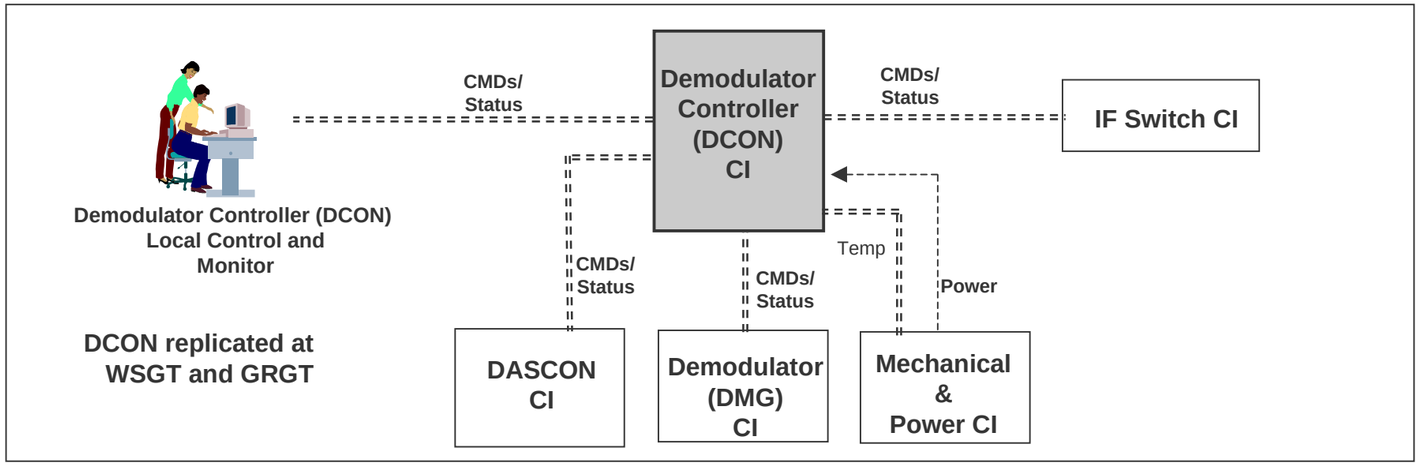
DASCON CI

Requirements Issues

- **Use of SWSI**
  - Customer interface is a key DASCON function
  - DAS/SWSI development schedules must be meshed
  - DAS/SWSI ICD to be developed to govern exchange of customer data
  - SW Design impact under assessment
- **Ops Alerts**
  - Original Concept was Go/No-Go
  - RFA requires “smart” alerts
  - SW Design impact under assessment
- **Security**
  - Requirements being developed
  - Early assessment is that new requirements are achievable
  - Will fully assess upon receipt of revised requirements

Demodulator Controller (DCON) CI

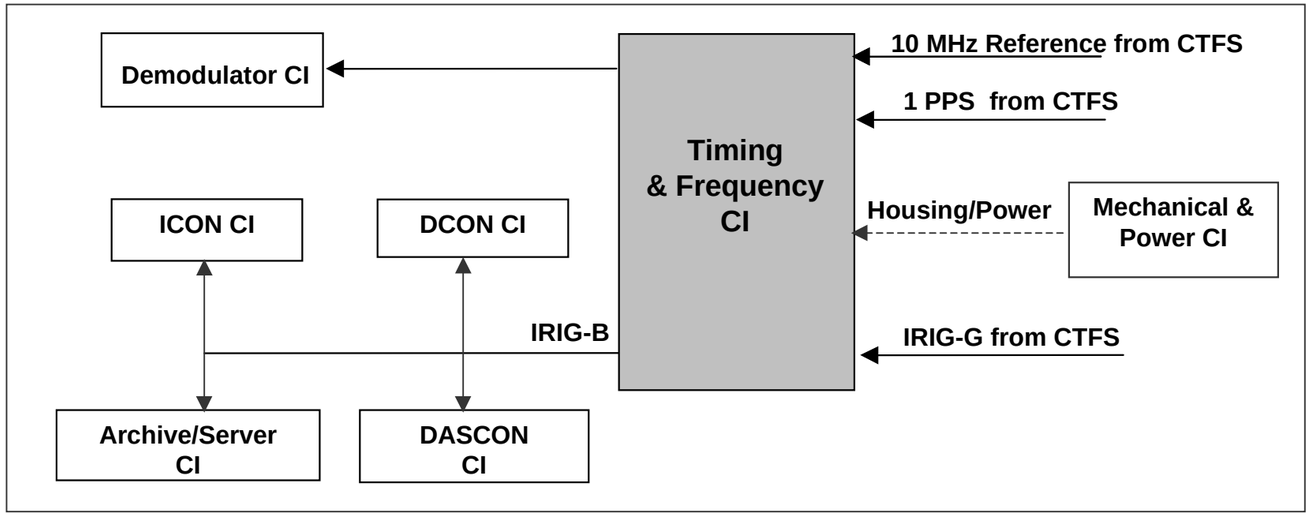
Interfaces and Key Requirements



- Establish network connection to the Demodulator Groups (DMGs) and the IF Switch
- Establish connection with DASCON to accept data and command messages to support the customer service demodulation
- Provide an operational interface to monitor, coordinate, control, and report the performance of DMGs, IF Switch, and the DCON components

Frequency and Timing CI

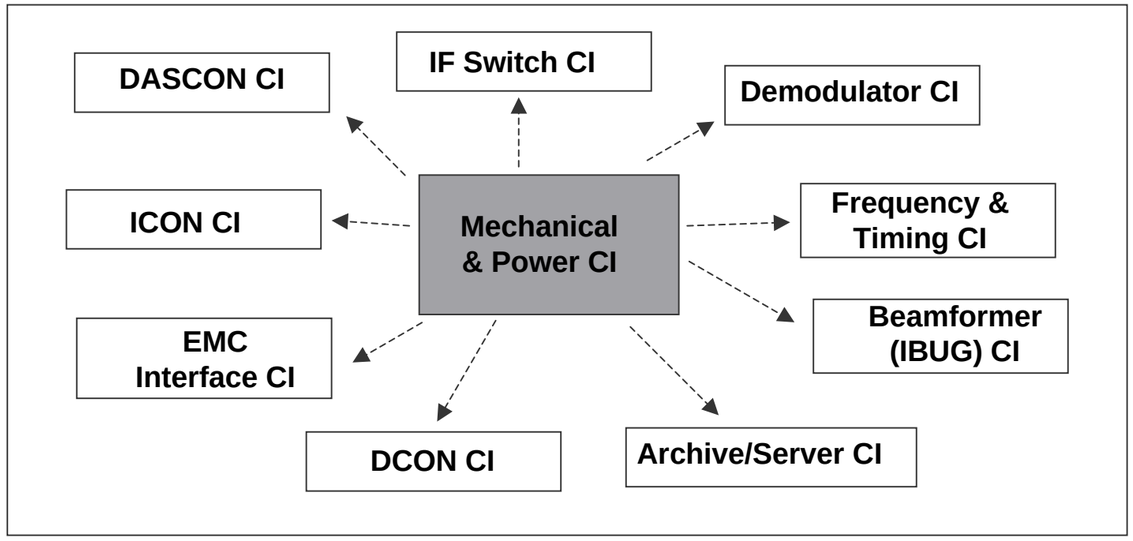
Interfaces and Key Requirements



- Distributes CTFS 10 MHz reference and the One-Pulse-Per-Second (1 PPS) to the DMGs
- Converts IRIG-G to IRIG-B for distribution to the DCON, ICON, DASCON, Archive/Server

Mechanical and Power CI

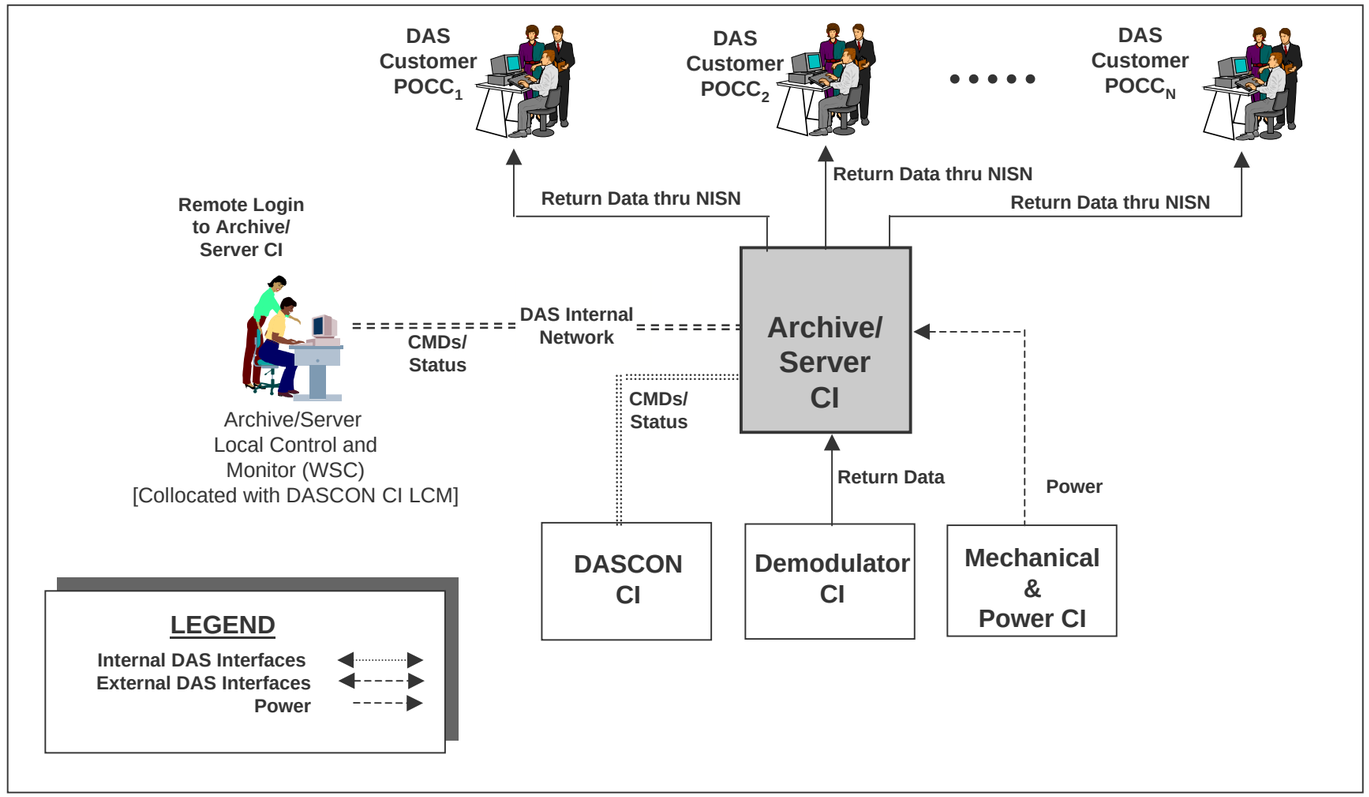
Interfaces and Key Requirements



- Provide interfaces for facility AC power, grounding, cooling air, and space
- Provide an Over-Temperature Sensing Unit (OTSU) to protect CI equipment

Archive/Server CI

Interfaces



Archive/Server CI

Key Requirements

- ❑ **Accept return data archiving and distribution service commands from the DASCON CI**
- ❑ **Accept return telemetry data from the Demodulator CI**
- ❑ **Archive all return data**
- ❑ **Distribute return data in real-time to DAS Customers if specified by the service**
- ❑ **Retrieve return data from archive and distribute it according to service specifications**
- ❑ **Report operational status to the DASCON CI**

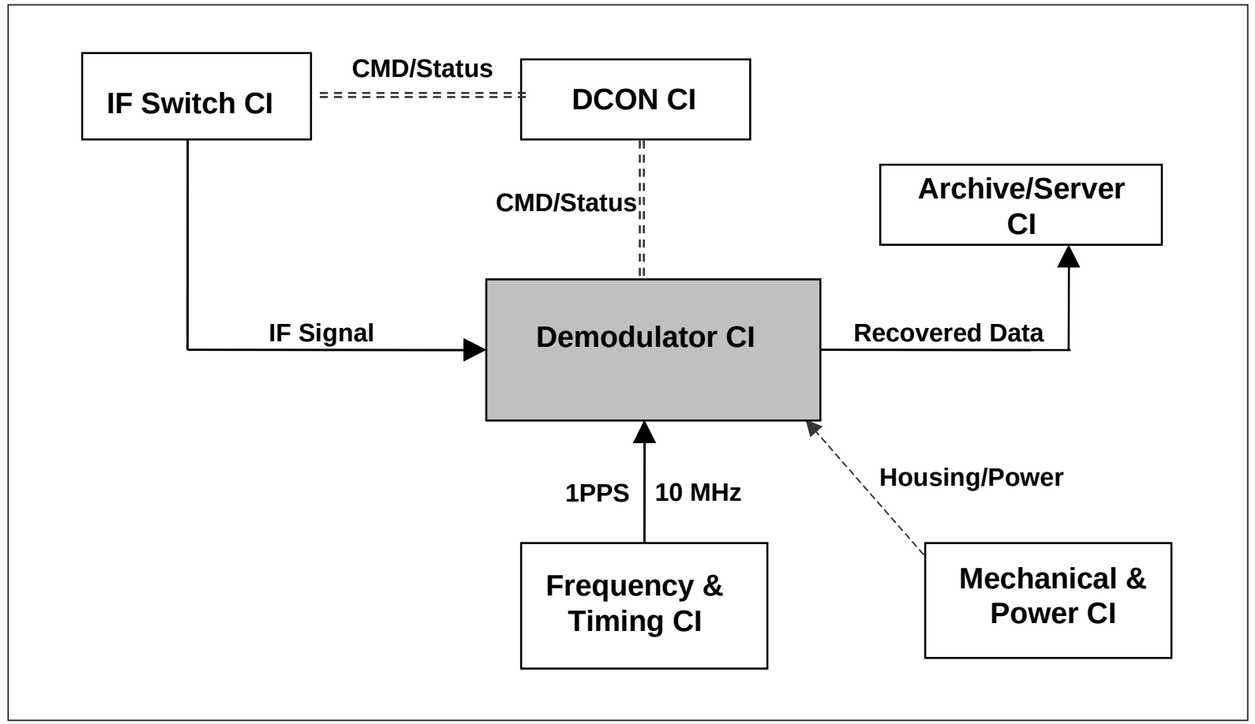
Archive/Server CI

Requirements Issues

- **RFA 450/145-01**
  - Replaced CCSDS SLE with requirement to “mimic current WDISC telemetry formats”
  - NASA to define formats by 11/30/00
  - SW design impact
  - Assessment to be initiated upon receipt of requirements

Demodulator CI

Interfaces



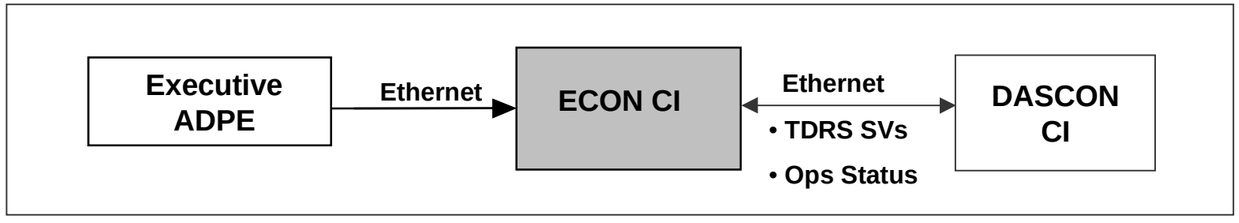
Demodulator CI

Key Requirements

- **Each individual receiver in the CI shall provide signal demodulation**
  - PN despreading
  - Carrier tracking and demodulation
  - Symbol tracking and detection
- **Demodulator CI shall receive configuration settings and provide status to the DCON via an Ethernet connection**
- **Demodulator CI shall provide DCON with configuration and status information from individual receivers**
- **Achieve specified Acquisition Time, Implementation Losses, and support data rates from 1-150 Kbps**

ECON CI

Interfaces



- ECON is part of Legacy WSC equipment and not part of DAS
- Under the DAS implementation program effort, ECON SW is being upgraded to support DAS
- ECON shall receive TDRS State Vectors from its associated Executive ADPE
- ECON shall provide DAS with these TDRS SVs and TDRSS status data

Critical System Performance Requirements

Analysis and Allocation

- **Critical System-Level performance requirements are:**
  - DAS Implementation Losses (relative to BER performance)
  - Signal Acquisition Time
  - Receiver/Decoder Sync Time
  - DAS Availability (included in RMA Analysis)

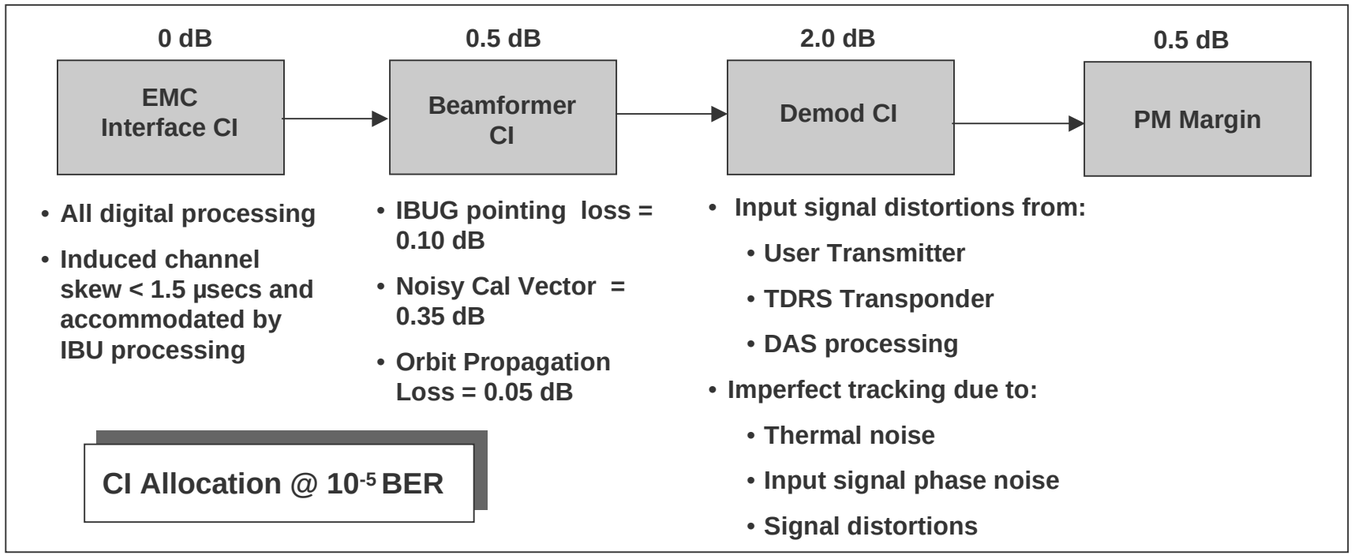
- **Allocations have been assigned, as appropriate, to individual DAS CIs**

- **Preliminary analyses and previous implementations indicate that DAS CIs will meet these requirement allocations**

Critical System Requirements

Implementation Loss (SRD 3.2.4.2.1.6)

The DAS Implementation loss shall be:
< 3.0 dB @ 10^{-5} BER
< 3.2 dB @ 10^{-6} BER
< 3.4 dB @ 10^{-7} BER



Critical System Requirements

Acquisition Time (SRD 3.2.4.2.1.7)

The DAS Acquisition Time (PN and Carrier) shall be:
< 1 sec (User oscillator ∆F = ± 700 Hz)
< 3 secs (User oscillator ∆F = ± 3 KHz)

- **Signal Acquisition Time requirements allocated to DMG (receiver/demod) only**
- **PN Acquisition**
  - Driven by: C/No, data rate (transitions), and frequency uncertainty
  - 256 -stage (128 taps) PN Code Matched Filter using pre- and post-detection accumulations to ‘build-up’ SNR
  - Previous efforts have achieved < 1-2 secs for different but comparable conditions
  - Preliminary analysis suggests that DAS acq requirement will be achieved
- **Carrier Acquisition**
  - FFT-based acq scheme with bin size < carrier loop bandwidth
  - Previous efforts have achieved < 0.2 secs for different but comparable conditions

Critical System Requirements

Receiver/Decoder Sync Time (SRD 3.2.4.2.1.8)

The DAS receiver/decoder 99% sync time shall be:

< 1100*bit times (for Bi-ϕ symbol format)

< 6500*bit times (for NRZ symbol format)

- **Signal Synchronization Time requirements allocated to DMG (receiver/demod) only**
  - All 3 tracking loops converge mutually and simultaneously
- **<u>Loop Pull-in time</u> (Tpu) driven by largest parameter uncertainty after carrier acq (e.g.; frequency offset f_o ~ 5 Hz)**

  Tpu = 3.5 $(f_o)^2/B_L^3$ ~ $3.5(5)^2/(0.01/Ts)^3$ ~ 100 Ts = 50 Bit Times
- **<u>Settling time</u> (Tse) is given by smallest loop bandwidth (PN loop B_L ~ 5 Hz $\rightarrow$ $B_L T = 0.0025$)**

  Tse = $1.5/B_L$ ~ $1.5/(0.0025/Ts)$ ~ 600 Ts = 300 Bit Times
- **<u>Decoder Sync time</u> (Tds) represents proper selection of G1 and G2 symbols for decoding**
  - On-chip sync function works slowly at low Es/No's
  - ITT approach based on Deep Space algorithm (Tds~ 550 Bit Times)

Critical System Requirements

DAS RMA

The following RMA topics are discussed:

- ❑ **LRU Identification**
- ❑ **Availability Allocation**
- ❑ **Availability Prediction**
- ❑ **FMEA Assessment**
- ❑ **Safety Assessment**

Line Replaceable Unit (LRU) Identification

- **An LRU is defined as a piece of equipment which can be replaced on-site to return the system to its operational capability**

- **Individual CIs have been reviewed to define preliminary Line Replaceable Units (LRUs)**

Configuration Item	Line Replaceable Unit	
EMC Interface	• Control Processor • Fiber Optic Switch • Fan • Power Supply	• Common Data Broadcast S • NTS Chassis • Port Card
IBUG	• Control Processor • IBU Card • Power Supply	• Fiber Channel Receiver Ca • Chassis • Fan
IF Switch	• Chassis • Output Card	• Input Card • Power Supply
DEMOD	• Control Processor • Chassis • Fan	• DMU Card • Power Supply
Frequency and Timing	• Pulse Distribution Module • RF Distribution Unit	• Switch and Distribution Unit • IRIG G to IRIG B Assembly
ICON	• Server Assembly • Fan • Display	• Power Supply • Ethernet Hub
DCON	• Server Assembly • Fan • Display	• Power Supply • Ethernet Hub
DASCON	• Server Assembly • Power Supply • Ethernet Hub • Keyboard • Printer	• Hard Disk Drive • Fan • Display • Mouse
Archive/Server	• Server Assembly • Power Supply • Ethernet Switch	• Hard Disk Drive • Fan
Mechanical and Power	• Temperature Monitor	

Availability Allocation to CIs

- **An Availability Allocation has been performed to flow-down system-level requirements to the CIs**
  - Mean Time Between Failures (MTBF)
  - Mean Time To Repair (MTTR)

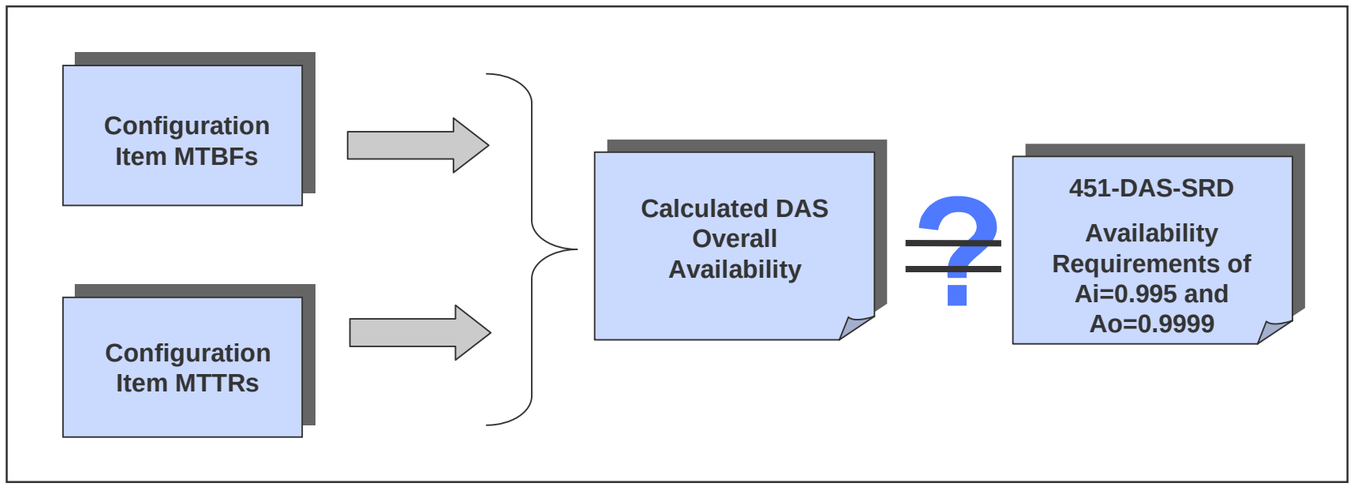
- **Allocated values are based on experience with similar components from previous programs**

Configuration Item	MTBF (hr)	MTTR (min)
Beamformer (IBUG)	9,500	25
Demodulator Group (DMG)	7,500	25
EMC Interface	8,500	20
Frequency and Timing	42,000	30
IF Switch	125,000	30
IBUG Controller (ICON)	11,000	35
Demodulator Controller (DCON)	11,000	35
DAS Controller (DASCON)	8,000	25
Archive/Server	11,000	35
Mechanical and Power	400,000	20

Availability Prediction

An Initial RMA Prediction was performed to determine the capability of the DAS design to meet the availability requirements of:

0.995 for inherent availability (Ai), and
0.9999 for operational availability (Ao)



Availability Prediction Methodology

- **The system availability prediction was calculated using the procedures outlined in the DAS Specification, 451-DAS-SRD**

- **MTBF values for each CI/LRU were calculated using MIL-HDBK-217F for the Ground Benign Environment at 25ºC**
  - Vendor data was substituted whenever possible
  - In several instances, limited reliability data required engineering assumptions

- **Allocated MTTR values were used**
  - Time to fault isolate to an individual LRU was assumed to be one (1) hour

Availability Prediction Results

- **Results indicate that the DAS design will meet the required availability**
- **Calculated inherent availability for the current design is > 0.995**
- **A final prediction will be performed prior to CDR**

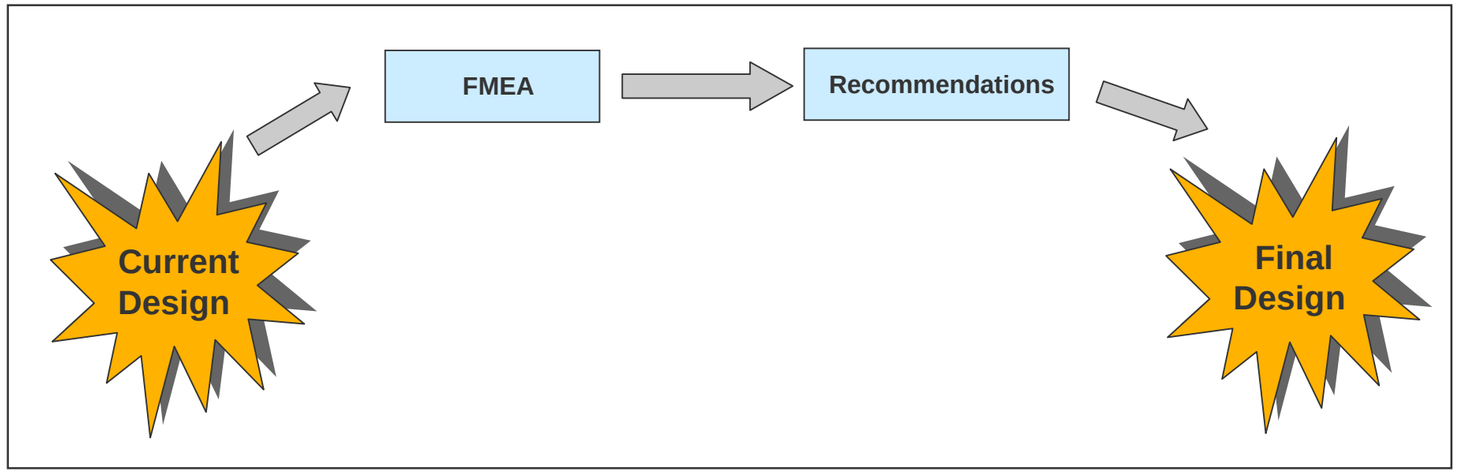
CONFIGURATION ITEM (CI)	MTBF (hr) 1	MTTR (min) 2	Notes
Beamformer (IBUG) CI	12,568	25	
Demodulator (DEMOD) CI	12,652	25	
EMC Interface CI	9,761	20	
Frequency and Timing CI	42,480	30	
IF Switch CI	125,000	30	
IBUG Controller (ICON) CI	12,458	35	
Demodulator Controller (DCON) CI	12,458	35	
DAS Controller (DASCON) CI	8,112	25	
Archive/Server CI	13,800	35	
Mechanical and Power CI	435,000	20	
WSGT System Inherent Availability	0.9990		3,4
GRGT System Inherent Availability	0.9994		3,5
WSGT System Operational Availability	Tbd		6
GRGT System Operational Availability	Tbd		6

NOTES:

1) MTBF Prediction based on calculated CI MTBF values from Relex Software Program.
2) Allocated values from DAS RMA Allocation Report. Final MTTR values will be incorporated in Final Prediction Report.
3) Inherent Availability includes 1 hour of diagnostic time.
4) WSGT System contains all Configuration Items
5) GRGT System contains all Configuration Items EXCEPT the EMC Interface and DASCON CIs.
6) Operational Availability to be calculated after redundancy defined.

Failure Modes Effects Analysis (FMEA)

An initial FMEA was performed to identify failures, their effect and detectability in order to mitigate performance risk



FMEA Methodology

- **FMEA performed using the functional approach described in MIL-STD-1629**
  - Potential failure modes were analyzed to determine cause, effect and severity
  - Catastrophic and Critical failure modes were compiled to identify areas that require special attention
  - Recommendations were made to mitigate failure modes

SEVERITY CLASSIFICATION		
Category	**Description**	**Mishap Definition**
I	**Catastrophic**	**Loss of DAS and Adverse Impact to External/ Interfacing System Components**
II	**Critical**	**Loss of DAS or Message**
III	**Marginal**	**Degradation of DAS**
IV	**Negligible**	**Unscheduled Maintenance or Repair, Inconvenience only**

Preliminary FMEA Results

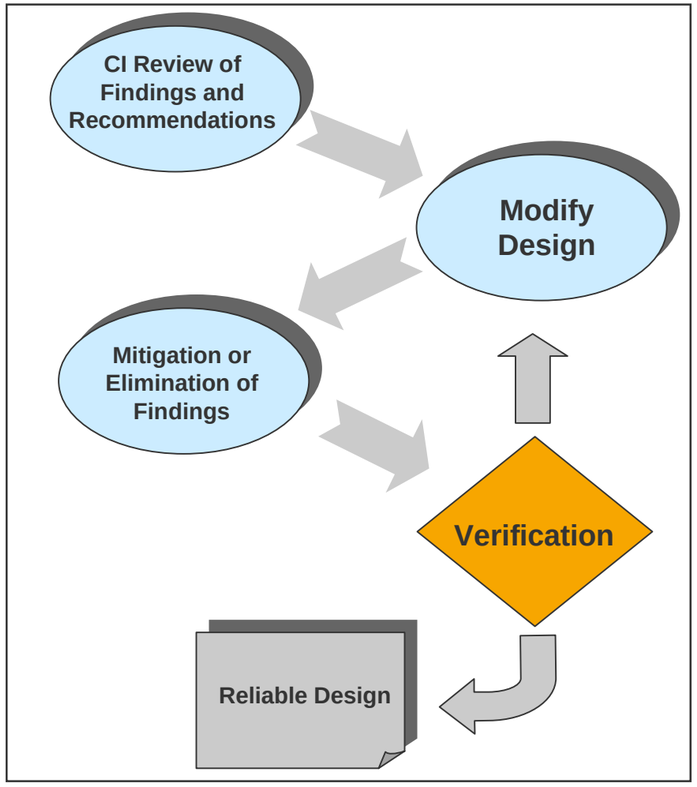
- **Preliminary FMEA results not yet reviewed by CI Development Team**
- **690 potential failure modes were identified by Product Assurance Team**
  - No Category I (Catastrophic) failure modes were found
  - 334 Category II (Critical) failure modes were found
  - Recommendations were provided to eliminate/mitigate each of the failure modes identified

Representative Worksheet (Demod CI)

ID No.	Item/ Functional Identification	Failure Modes And Causes	Failure Effect			Severity Class	Remarks
			Local	Next Higher Assembly	End		
1-1 Open	DMU	Loss of inputs due to IF Switch Interconnect failure	Data signals not received by Demodulator	No effect	Loss of 12 signal processors – mission failure	II	Provide Go-No go monitoring of inputs. Provide alert when any are lost.
1-2 Open	DMU	Low inputs due to IF Switch Interconnect failure	Low signals received by Demodulator	No effect	Loss of 12 signal processors– mission failure	II	Provide Go-No go monitoring of inputs. Provide alert when any are lost.
1-3 Open	DMU	Noisy inputs due to IF Switch Interconnect failure	Noisy signals received by Demodulator	No effect	Loss of 12 signal processors– mission failure	II	Provide filtering to eliminate noise.
1-4 Open	DMU	Loss of single input due to IF Switch Interconnect failure	Single data signal not received by Demodulator	No effect	Loss of signal processor – mission failure	II	Provide Go-No go monitoring of inputs. Provide alert when any are lost.
1-5 Open	DMU	Low single input due to IF Switch Interconnect failure	Single low data signal received by Demodulator	No effect	Loss of signal processor – mission failure	II	Provide Go-No go monitoring of inputs. Provide alert when any are lost.

FMEA Follow-on

- **Each identified failure mode will be reviewed and mitigated by the CI Lead**
  - Reliability of designs will be enhanced through the incorporation of design modifications
- **A final FMEA will be performed, prior to CI acceptance testing to verify mitigation of identified failure modes**



System Safety Evaluation

- **An evaluation was performed to identify, during normal system operation, potential failure modes that would result in a safety hazard**
  - The current design was reviewed for hazards identified from analyses on similar programs
- **No significant hazards were identified**
  - Use of hazard labels - Two Person Lift, High Voltage, etc
- **A Safety Assessment will be performed prior to CDR to ensure the design incorporates the proper safety features**

Integrated Logistic Support Plan (ILSP)

- **A Draft ILS Plan (ILSP) has been generated to define the programmatic and management structure to be used for the DAS Program**
  - Establishes responsibilities across organizations
  - Defines the maintenance concept
  - Identifies the Field-Replaceable components
  - Identifies the Operational information required to evaluate spare quantities

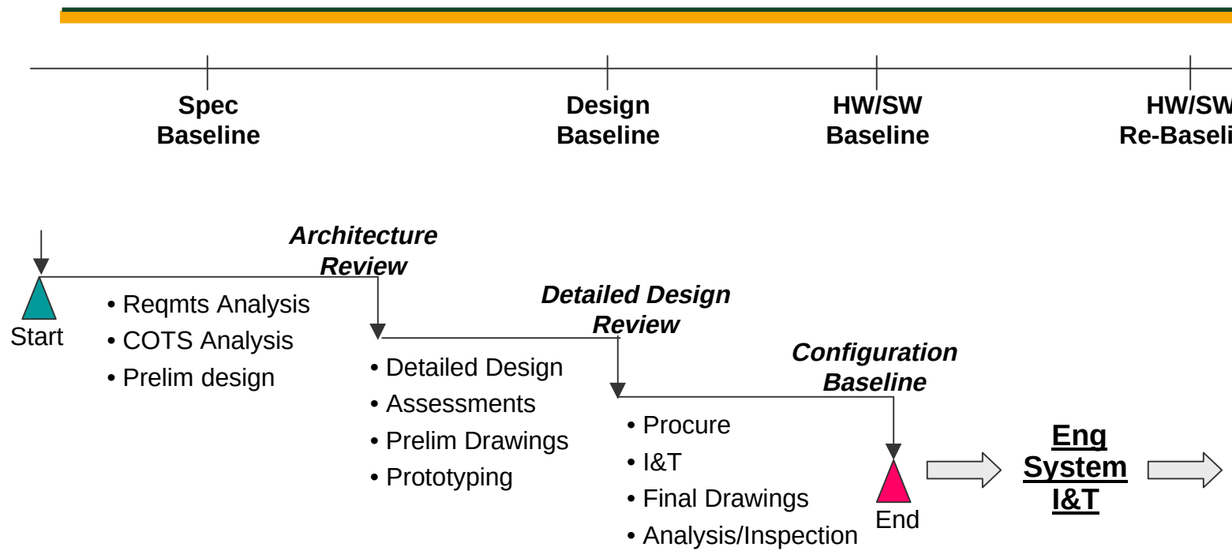
PDR Agenda

- ❑ Program Overview
- ➔ System Overview
- ❑ Requirements Analysis
- ⇨ ❑ System Verification and Testing
- ❑ Hardware Design
- ❑ Software Design
- ❑ Summary

Verification Overview

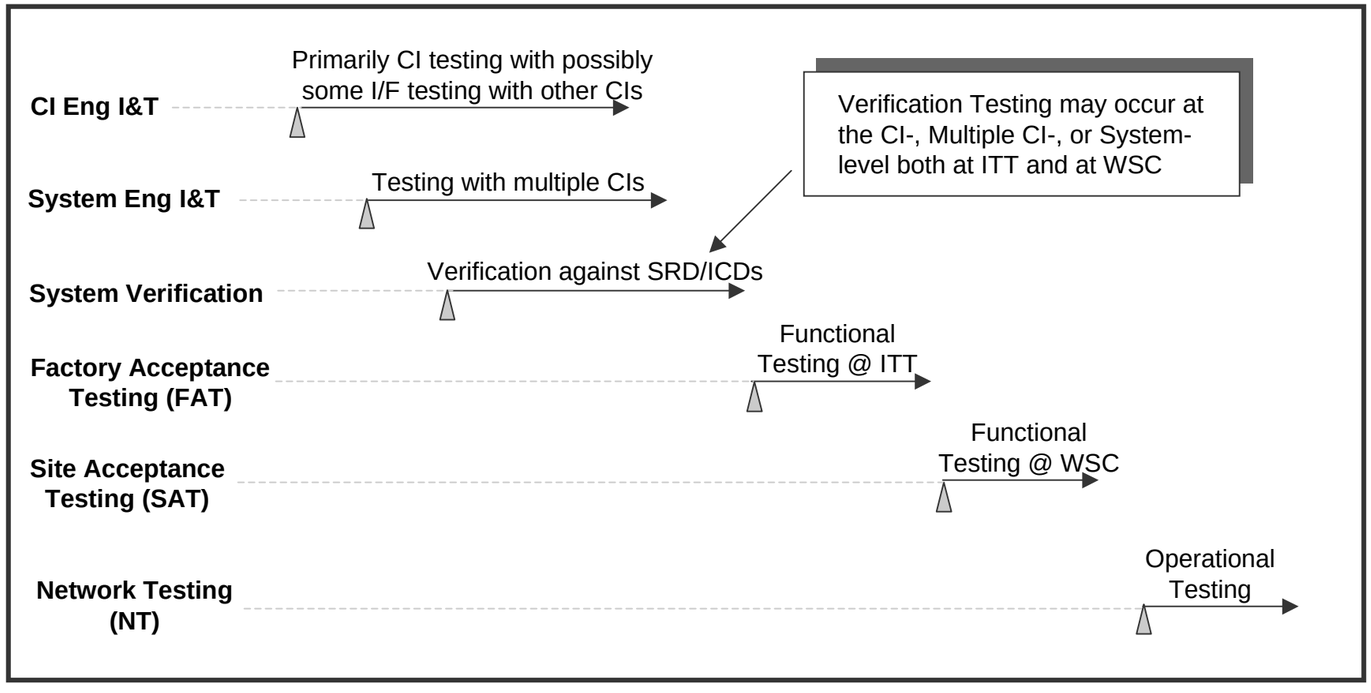
- **The Performance Verification Matrix (PVM) identifies the verification approach for each and every DAS SRD requirement**
  - Analysis
  - Inspection
  - Demonstration
  - Test
- **The DAS Verification Plan will describe how each requirement will be verified in accordance with the method stated in the PVM**
  - The plan will also describe all test-bed configurations
  - The Test Procedures will document the testing to be done in greater detail
- **The PVM in each CI-Level Specification provides requirements traceability**
  - All CI-level requirements (direct and derived) are traceable to a SRD requirement
- **For COTS equipment, certificates of compliance will be used as appropriate**
  - FAT will be conducted for the ITT IBUG along with a Certificate of Compliance against detailed SRD requirements

Internal CI Design Review Process



- SE involved in an on-going review process with developers
- Review documentation at key milestones maintained under CM
- SE will generate DAS Verification Plan

Test & Verification



Sample PVM Entry

Unique Req. ID No. 1

SRD Requirement Text:

The DAS shall process DAS Customer system access identification information as part of DAS logon procedures.

SRD Section No.
3.1.1.a

Verification Method	*Verification Document ID*	*Verification Case ID*	*Verification Test ID*	*Verification Report ID*	*DAS Reqt Status*	*Verification Status*	*NASA Approval Status*
Demonstration							

Comments:

Test Method Definition - Analysis

- **Analysis is the method used to verify that an item conforms to the specified requirements by:**
  - Computation
  - Modeling
  - Simulation
  - Analytical solutions
  - Studies
  - Reduced or representative data

- **In performing analysis, verification personnel shall:**
  - Study and examine engineering drawings, software and hardware flow diagrams, and specifications
  - Perform modeling and simulation and assess the results
  - Perform a combination of above activities

Test Method Definition - Inspection

- **Inspection is the method used to verify the physical characteristics of the product (e.g., size, weight, appearance) adherence to specified standards and engineering practices, and quality of design and construction by examining the equipment in comparison with associated documentation**
- **Inspection determines conformance to requirements without the use of special test equipment or analysis techniques**
- **In conducting inspections, verification personnel shall:**
  - Use inspection tools and measurement devices to perform a visual survey of the product
  - Note the results of their inspection for comparison with the required physical characteristics of the product
- **Inspections may be performed during any assembly stage of the product**

Test Method Definition - Demonstration

- **Demonstration is the method used to verify that an item conforms to the specified requirements by observing the operation and functional performance of the product, or part of the product, generally without the use of special instrumentation to record quantitative measurements**

- **This method is generally used when a requirement does not contain a specific numerical parameter that may be measured**

- **Since no quantitative values are specified for demonstrations, pass/fail criteria are “yes/no” indications of functional performance**

- **Demonstrations may be performed during any assembly stage of the product**

Test Method Definition - Test

- **Test is the method used to verify that an item conforms to the specified requirements by thoroughly exercising the applicable item under specified conditions and by using the appropriate instrumentation in accordance with test procedures**
- **Tests are used to measure the attainment of specified numerical parameters. In conducting tests, verification personnel shall:**
  - Use laboratory equipment or simulators measure numerical parameters
  - Record measured values
  - Determine “pass/fail” by comparing measured value(s) with specified value(s)
- **Measurement accuracy shall be precise enough to ensure that the measured value is within the specified tolerance**
- **Tests may be performed during any assembly stage of the product**

System Test Schedule

Test	Schedule	Duration
System Design Verification	9/25/01 – 12/31/01	70 days
Factory Acceptance	1/3/02 – 1/28/02	18 days
System Acceptance (WSC and GRGT)	2/12/02 – 2/18/02 3/7/02 – 3/13/02	5 days 5 days
Network Testing	3/25/02 – 3/29/02	5 days

- Meets an Operational Capability Date of 4/25/02

PDR Agenda

- ❑ **Program Overview**
- ➔ **System Overview**
- ❑ **Requirements Analysis**
- ❑ **System I&T and Verification**
- ❑ **Hardware Design**
  - ➢ Mechanical & Power
  - ➢ IF Switch
  - ➢ Frequency & Time
  - ➢ EMC Interface
  - ➢ Demodulator
  - ➢ Beamformer
- ❑ **Software Design**
- ❑ **Summary**

Mechanical & Power CI
Allocated Requirements Overview

- **Functional**
  - Provide racks for all CIs
  - Provide all interconnects within and between racks and host site
  - Provide required grounding
  - Provide power to CIs
  - Provide EMI shielding
  - Temperature sensing

- **Key Drivers**
  - EMI compliance
  - Maintainability
  - Expandability

Design Response to Requirements

- Deployment will be expandable to support up to 50 users at WSC (STGT & WSGT) and 50 users at GRGT
- Electronic Equipment Racks IAW STDN No. 270.5 as amended by Deviation Request
- Cabling/Connectors per STDN SPECs 4 & 8
- Power distribution provided w/sufficient capacity
- Leverage Ethernet components which are highly reliable and provide appropriate interfaces
- Temperature monitor has alarm capability and 8 channels to accommodate extended install

Mechanical and Power

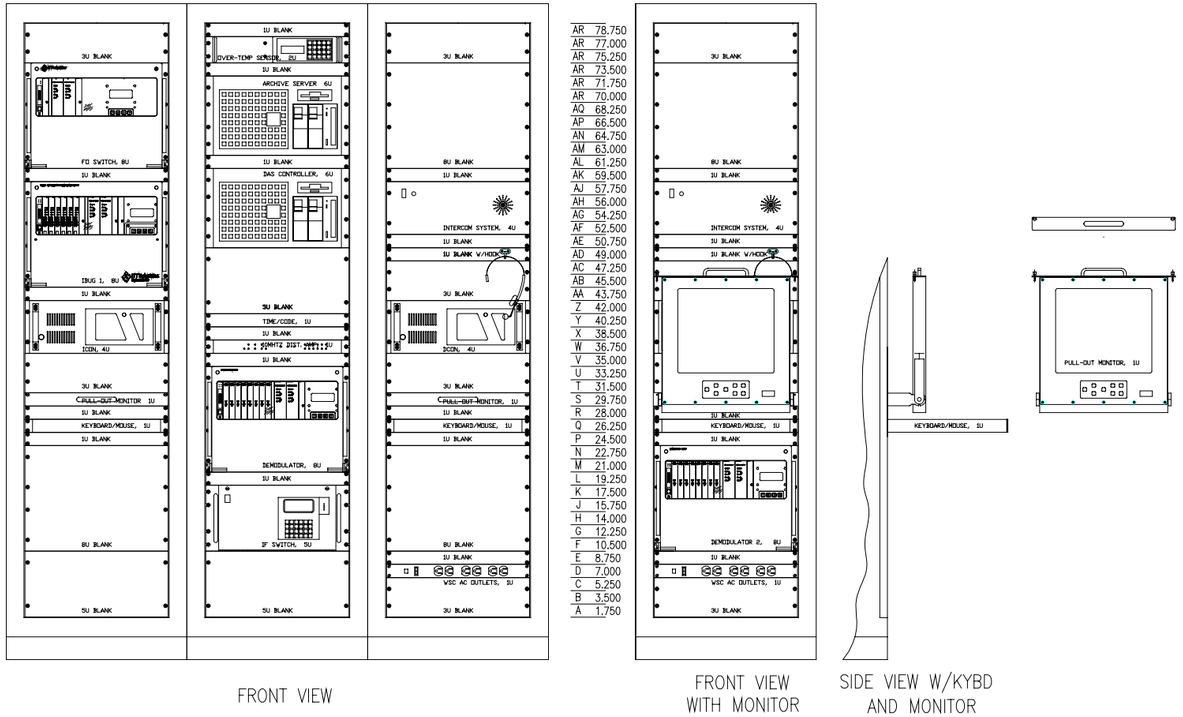
- Mechanical
- Custom I/O panels on doghouse in each rack
- Intermediate Bars and blank panels with EMI gaskets between each chassis
- STDN 270.5/SPEC-8 Hardware used where possible
- Exceptions to 20 inch depth requirement
  - Data Server
  - DASCON
- Power
- Egress through protective enclosure on ‘doghouse’
- Locking-type fastener to facility power
- Vertical STDN 270.5 compliant power strip inside racks
- All equipment operates on 110/120 volts ac

Electronic Equipment Racks

- Per 270.5, but with approved deviations
- Electromagnetic compatibility options installed but not required
- 3 enclosures per site for initial install, site plan call for up to 7 for extended install
- I/O ‘doghouse’ in each rack w/custom I/O panel in each rack
- Under-floor cabling for all I/O except IF cables
- Rear rack-mount rails will be rotated to allow for rear mounting of some components


One-bay enclosure

Initial Rack Install



FRONT VIEW

FRONT VIEW WITH MONITOR

SIDE VIEW W/KYBD AND MONITOR

Extended Rack Install

FRONT VIEW

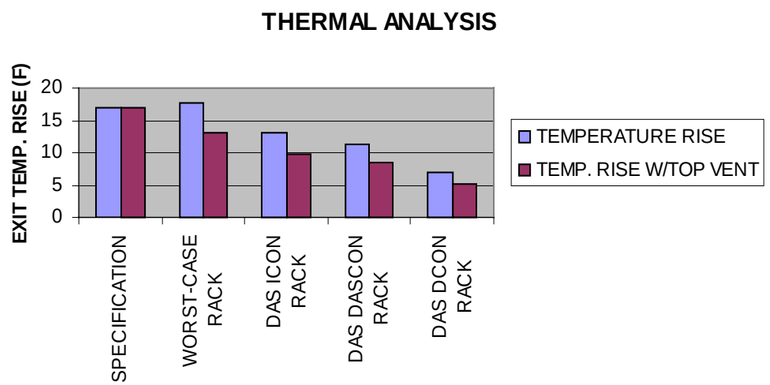
EMC D/S RACK

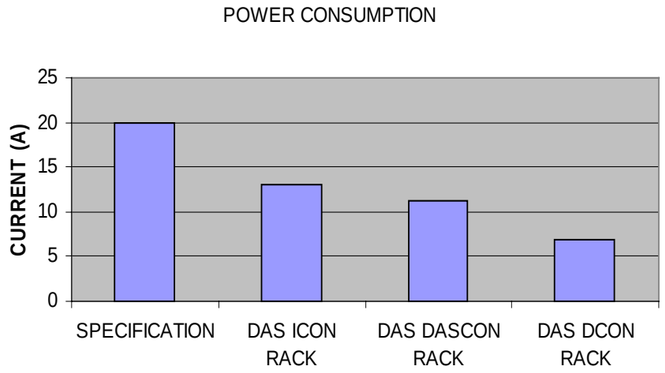
Thermal, Power, and Weight Analysis

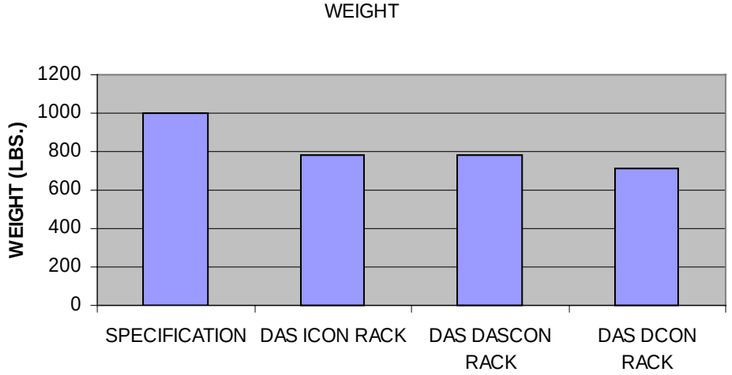
DAS SYSTEM MEETS SPECIFICATIONS

Assumes:

- **Thermal environment as specified in STDN SPEC-4, top vent added for worst-case rack**
- **20A Service per rack for internal equipment**
- **1000 Lb. Weight limit per rack as per STDN SPEC-4**

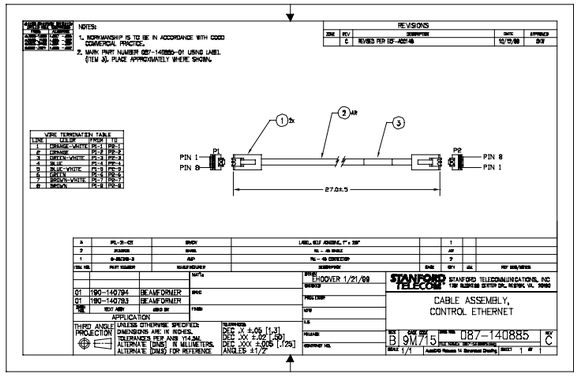






Cabling and Connectors

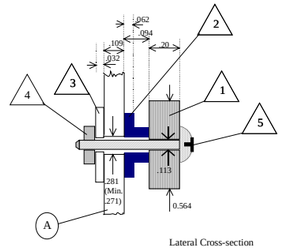
- Use connectors/cabling from STDN SPEC-8 (where applicable)
- Chassis interconnect cables labeled per 530-WSC-LOP-VII(1) No. 4
- All cable connections through I/O Panels except IF cables
- Class 2 engineering drawings in vendor engineering format as described in 500-TIP-3109



Temperature Sensor Components

- **LakeShore Model 218 selected features:**
  - Up to 8 probe inputs
  - Broad temp. range
  - +/- 1 degree accuracy
- **Custom probe configuration uses COTS parts to simplify mounting**
  - Single probe located at the DASCON (WSC) or DCON (GRGT) air inlet to monitor input air temperature
  - Each rack has a probe at the air exit vent at the top of the rack

Temperature Probes



Temperature Probe Mounting Detail

Ethernet & Printing Components

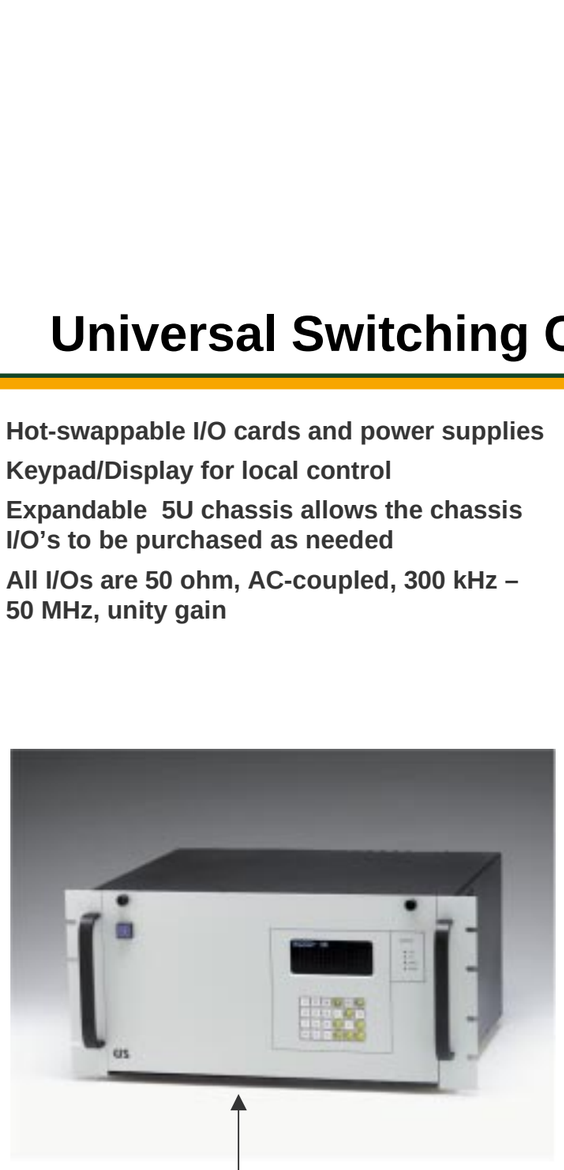
- 3Com SuperStack II Ethernet Hubs provide excellent reliability (MTBFs > 35 Years) and are identical to TGBFS hubs (thus reducing sparing)
- Ethernet Switch is identical to CDB Switch thus reducing sparing
- Ethernet hubs/switches mounted to rear rail of rack due to front interconnects
- Printer adjacent to DASCON monitor for hard-copy log of DASCON events

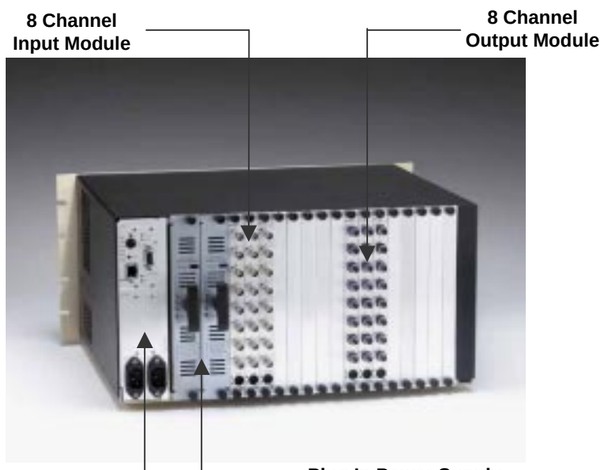
IF Switch CI
Allocated Requirements Overview

- **Functional**
  - Provide non-blocking one-to-one and one-to-many switch connectivity between IBUs and demods
  - Switch dynamically under command from DCON
- **Key Drivers**
  - Provide 64x64 non-blocking connectivity
  - Impart minimal signal distortion
  - +/- 1 dB gain linearity over the frequency range of interest

Universal Switching Corp S6400C-11-305HA

- Hot-swappable I/O cards and power supplies
- Keypad/Display for local control
- Expandable 5U chassis allows the chassis I/O's to be purchased as needed
- All I/Os are 50 ohm, AC-coupled, 300 kHz – 50 MHz, unity gain
- COTS solution meets current requirements, allows expansion to 64 x 64 switch
- Redundant I/O cards and power supply cards allow operation with single card supply failure
- Switch flexibility allows one-to-one or one-to-many flexibility on all ports



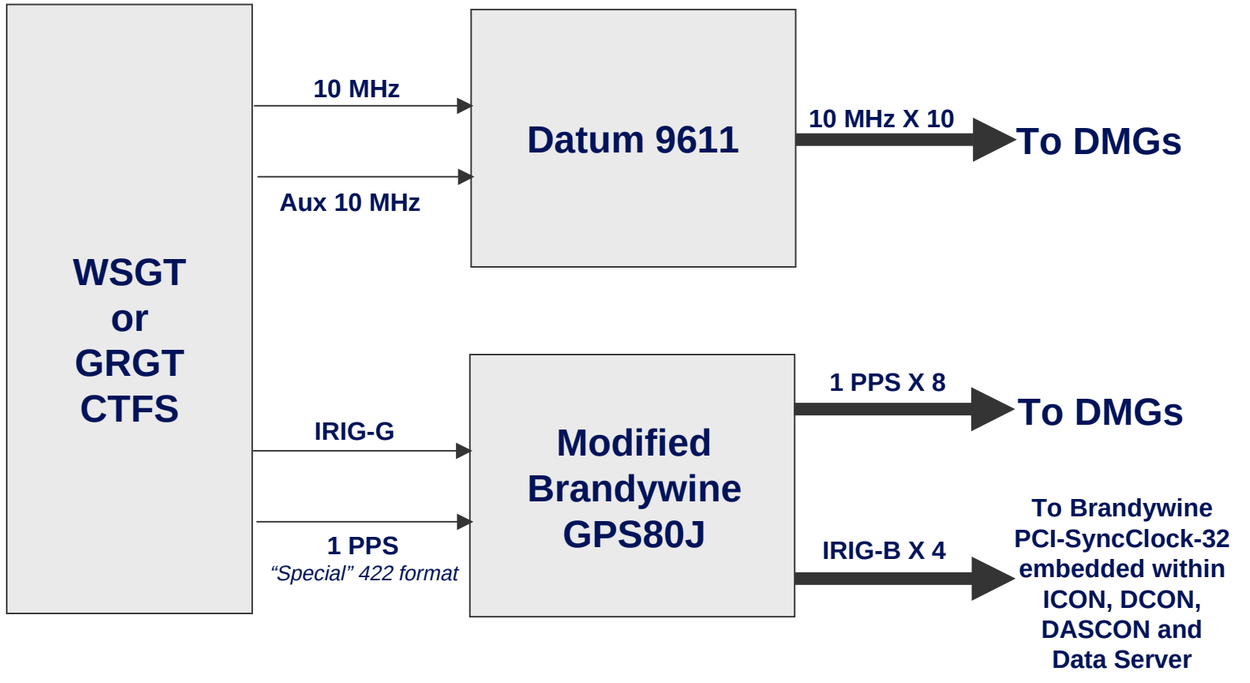


Frequency & Timing CI
Allocated Requirements Overview

- **Functional**
  - Provide timing and frequency references to DAS
    - Time code conversion (from IRIG-G to IRIG-B) and distribution
    - 1 Pulse Per Second distribution
    - 10 MHz frequency reference distribution

- **Key Drivers**
  - Precision requirements will be derived consistent with the development and assessment activities

DAS Frequency & Timing Solution



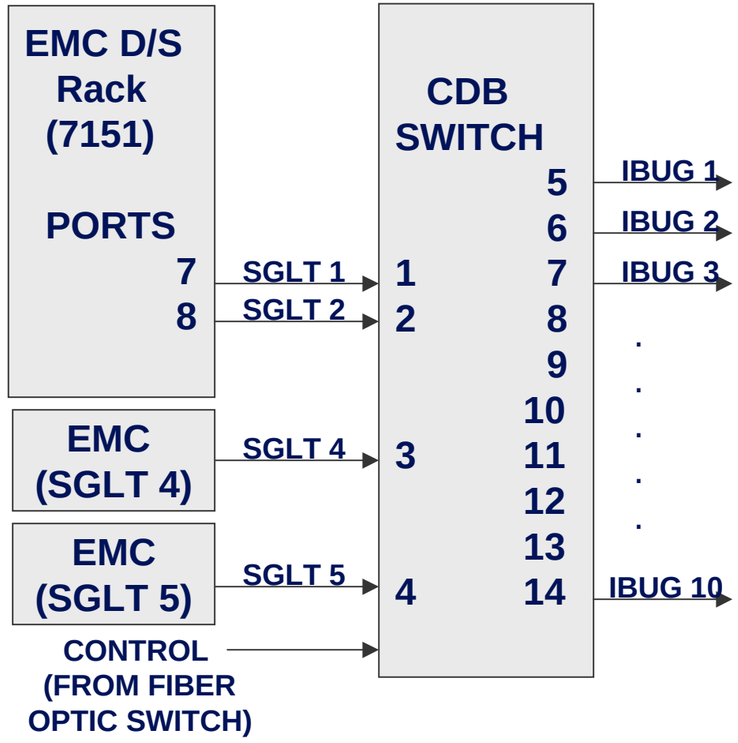
EMC Interface CI
Allocated Requirements Overview

- **Functional**
  - Reside at WSGT DAS only (not at GRGT)
  - Connect and switch Fibre Channel outputs from 4 EMCs (via the EMC-DS) to DAS Beamformers (all short wave)
  - Connect and switch Common Data Broadcast outputs from 4 EMCs to DAS Beamformers
  - Switch dynamically under command from ICON

- **Key Drivers**
  - Switch EMC Fibre channels to multiple IBUGs (one to many)
  - Switch EMC CDB Ethernet channels to multiple IBUGs
  - Maintain differential timing among EMC Fibre channels (skew < 1.5 microseconds)

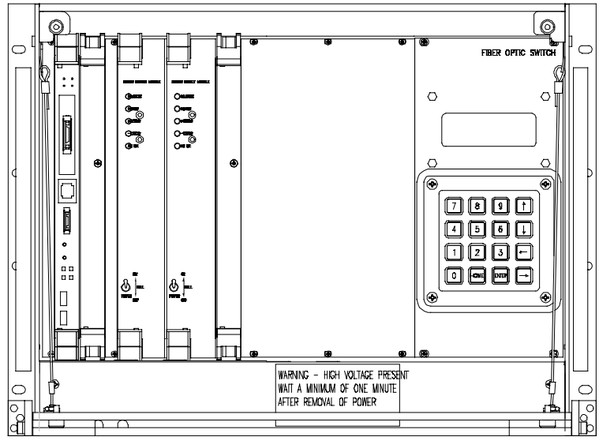
CDB Distribution

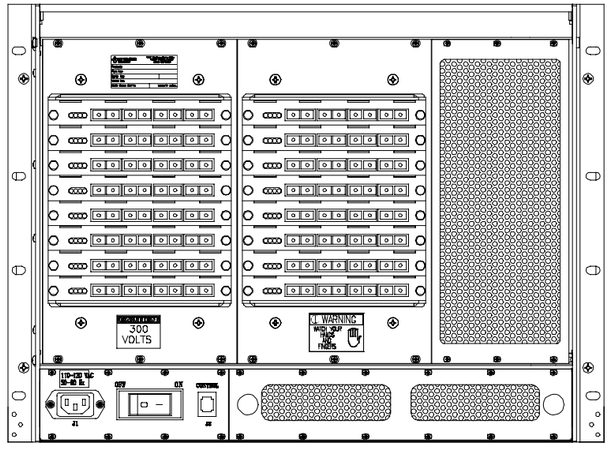
- Common Data Broadcast (CDB) inputs sourced from EMC D/S Switch Rack and WSC EMCs
- UDP Protocol allows for uni-directional data sends with an update rate of 1 second nominal
- CDB Switch will use Virtual LANs to map EMC inputs to desired IBUGs under control from Fiber Optic Switch



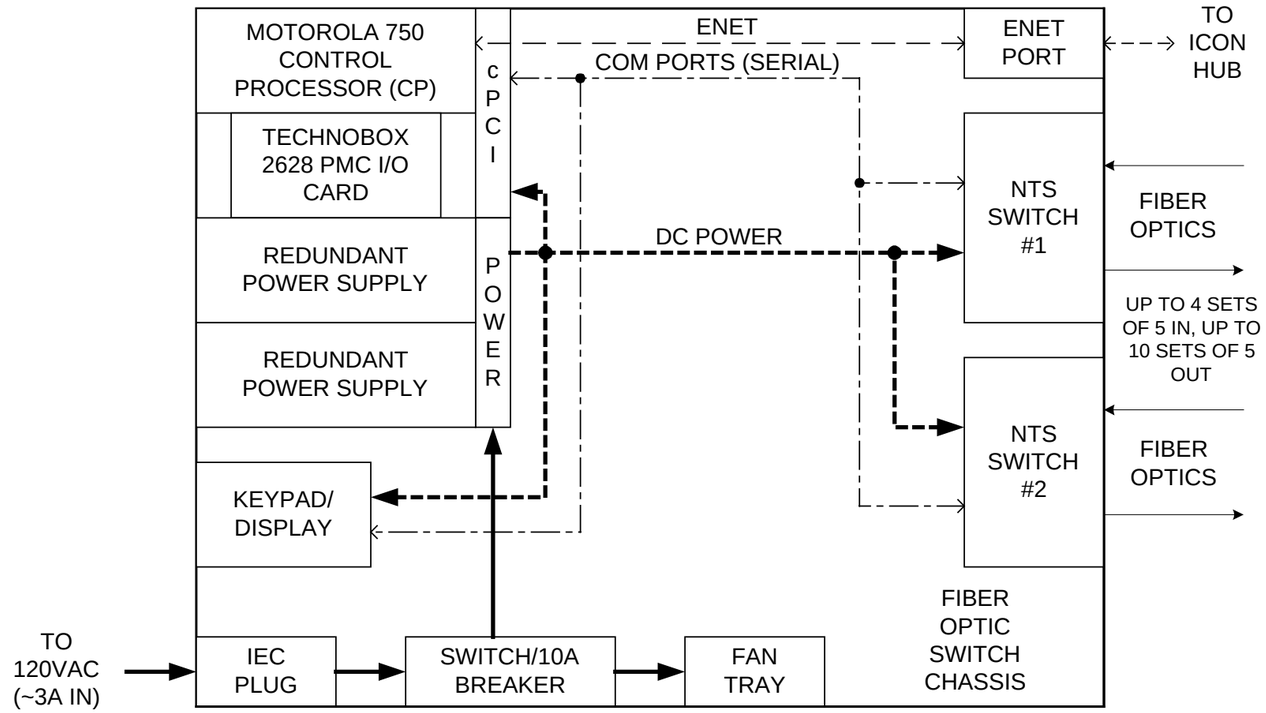
Fiber Optic Switch Mechanical Design

- ❑ Hot-swappable fan tray and power supplies
- ❑ Keypad/Display for local control
- ❑ Common parts with IBUG, Demodulator, and EMC chassis
- ❑ Smallest cPCI backplanes used to reduce chassis size
- ❑ Redundant power supplies sized to allow operation with one supply failure
- ❑ Chassis is slightly expanded version of IBUG chassis

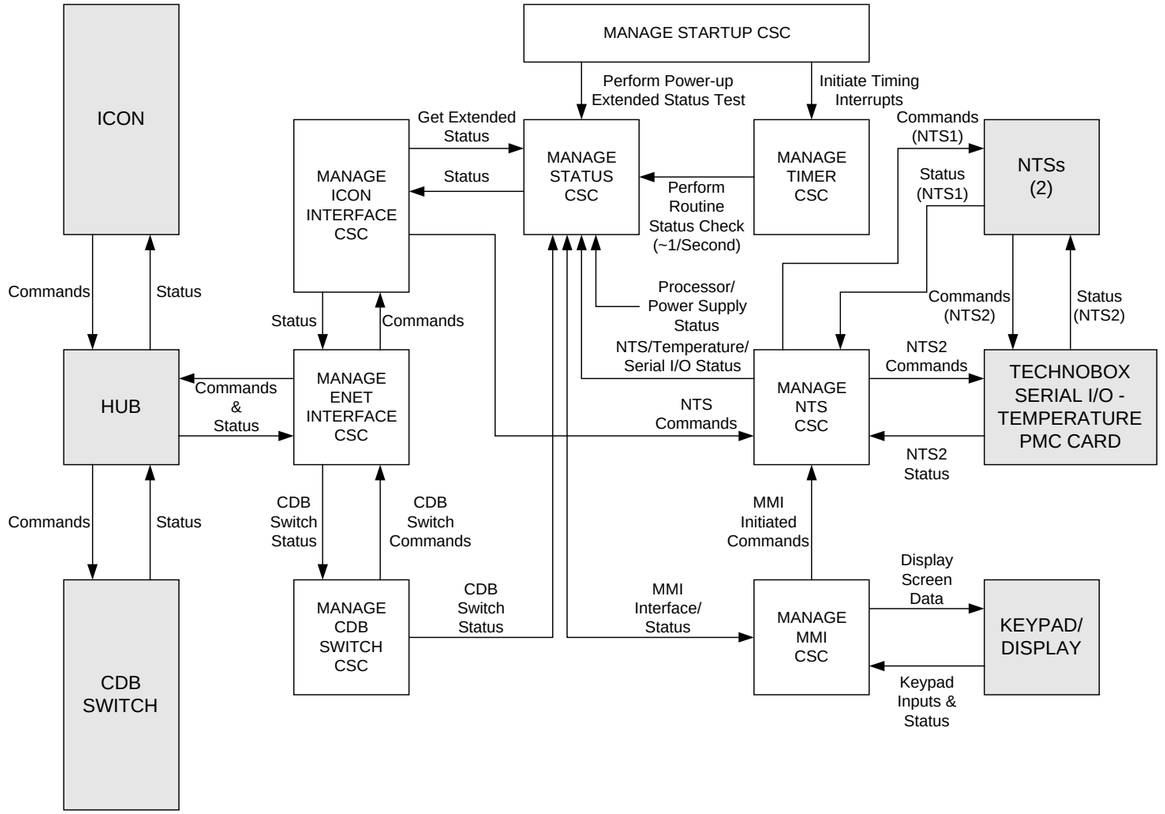




Fiber Optic Switch Interconnection Diagram



Fiber Optic Switch Firmware Data Flow Diagram



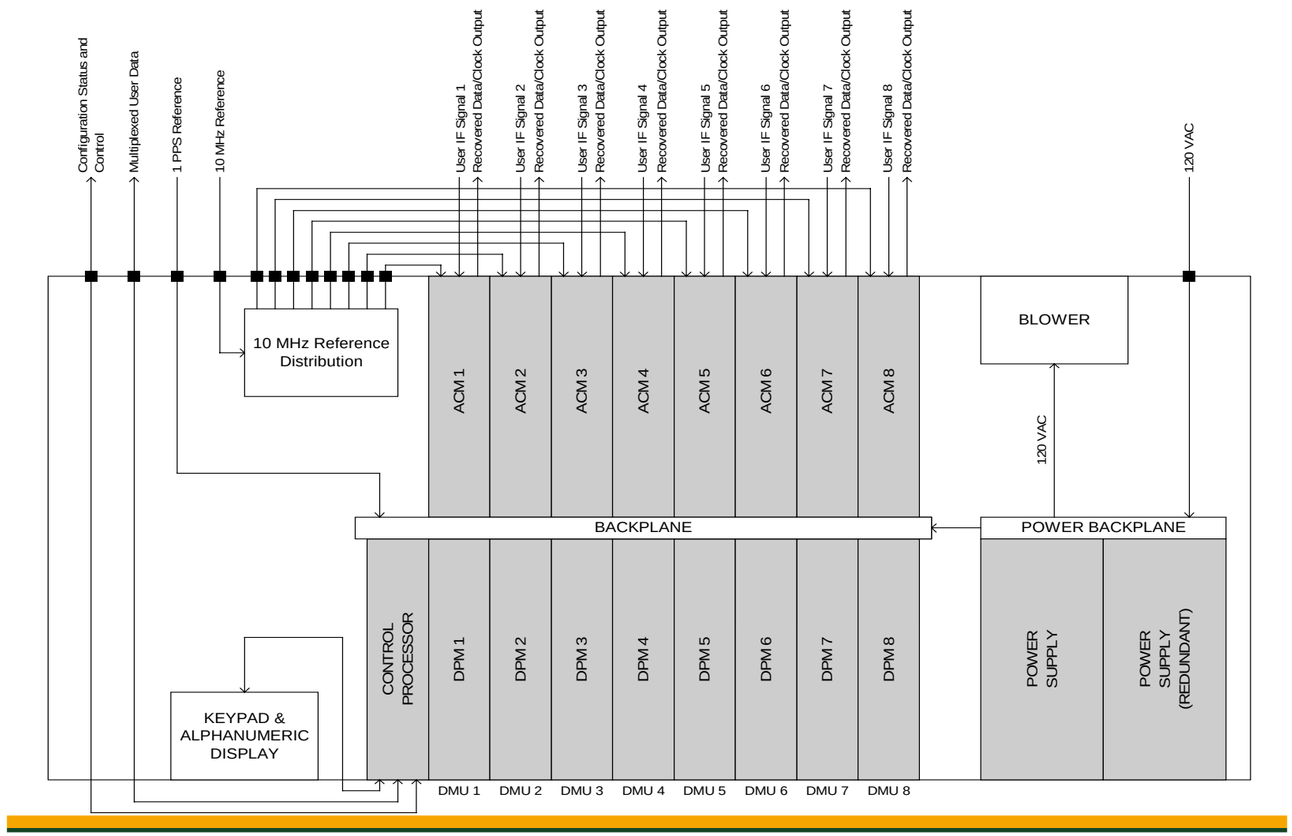
Fiber Optic Switch BIST

- **Routine Status**
  - Performed approximately once/second
  - Go/No Go status for all critical Fiber Optic Switch components
  - Compact 32-bit status word emphasizes any faults detected
  - Test is comprehensive, but return message is limited
- **Extended Status**
  - Provided on Power-Up and when requested by ICON or via keypad
  - Provides detailed status using approximately 8 32-bit status words
  - Formatted status words are interpreted using the ICD by either the ICON or the display for user intervention
  - ICON will query Fiber Optic Switch when ‘No Go’ status is sent for detailed explanation of fault

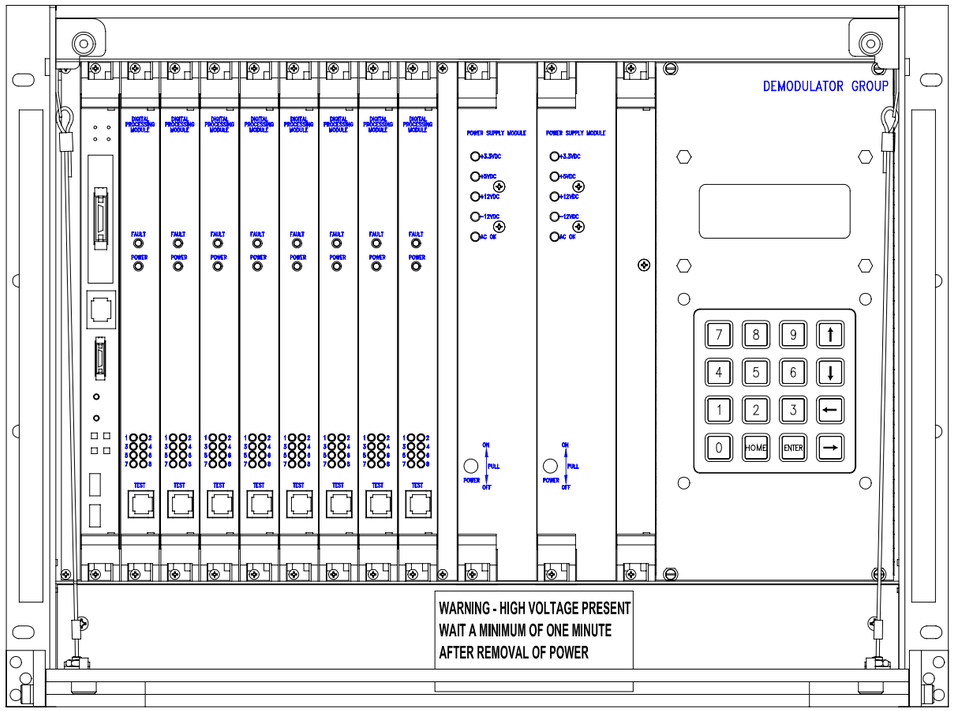
Key DMG Requirements

- **Failures shall be identifiable to one LRU**
- **Contractor shall use connectors, cable, wires and other parts consistent with industry standards**
- **The receiver equipment shall be mounted in standard 19” electronic equipment racks**
- **Individual receiver cards shall be removable without affecting any other receivers in the same chassis**
- **Individual power supplies shall be removable without affecting receivers in the same chassis**
- **All LRUs shall be “hot swappable” – can be removed and replaced without interruption of other system functions**
  - Exceptions: Control Processor and Blower (as with IBUG)

DMG Block Diagram



DMG Mechanical Design



DMG Design Overview

- **Mounts to standard 19” rack (8U high)**
  - Modeled after the TGBFS IBUG chassis
  - Allows exchange of some EMC and IBUG common components (power supplies, fans, etc.) – sparing advantages
- **All interfaces are accessible from the rear of the chassis**
  - Common design practice for ground station rack-mounted equipment
  - Standard connector types are used (SMA, RJ45, etc.)
- **Modular design allows Demodulator Units (DMUs) to be hot-swapped without affecting the function and performance of other DMUs**
- **Up to 8 DMUs per DMG**

DMG External Interfaces

- **IF (8.5 MHz) Signal Input**
  - Each ACM provides a SMA connector for input – accessible on the ACM faceplate
- **10 MHz External Reference Input**
  - Single input (bulkhead SMA connector) for the DMG located on the chassis rear panel
  - Internal 1:8 splitter routes outputs back to bulkhead SMA connectors on the rear panel – each connector is positioned directly below the ACM faceplate
  - Each ACM accepts (and requires) a copy of the 10 MHz reference
    - Right angle SMA connector accessible on the ACM faceplate
    - Short (6 inch) cables are used to route the splitter output signals to each ACM individually

DMG External Interfaces (Cont'd)

- **Pulse-Per-Second (PPS) Input**
  - Single input (bulkhead SMA connector) located on the chassis rear panel
  - Internal cabling routes PPS signal to a backplane connector
  - Backplane routes signal to each of the eight peripheral slots
- **Data/Clock Output (to facilitate testing)**
  - Each DMU's recovered data and clock signals are accessible at the ACM's faceplate
  - DB9 connector provides the output in a differential signaling format (RS-422)

DMG External Interfaces (Cont'd)

- **Status & Control Interface**
  - Connects to the Ethernet control port on the Control Processor
  - Cable routes signal to a pass-through RJ45 connector on the chassis rear panel
- **Multiplexed User Data Output**
  - Connects to the Ethernet data port on the Control Processor's SBS PMC 100BT
  - Cable routes signal to a pass-through RJ45 connector on the chassis rear panel
- **AC Line Power**
  - Switched / Circuit breaker protection

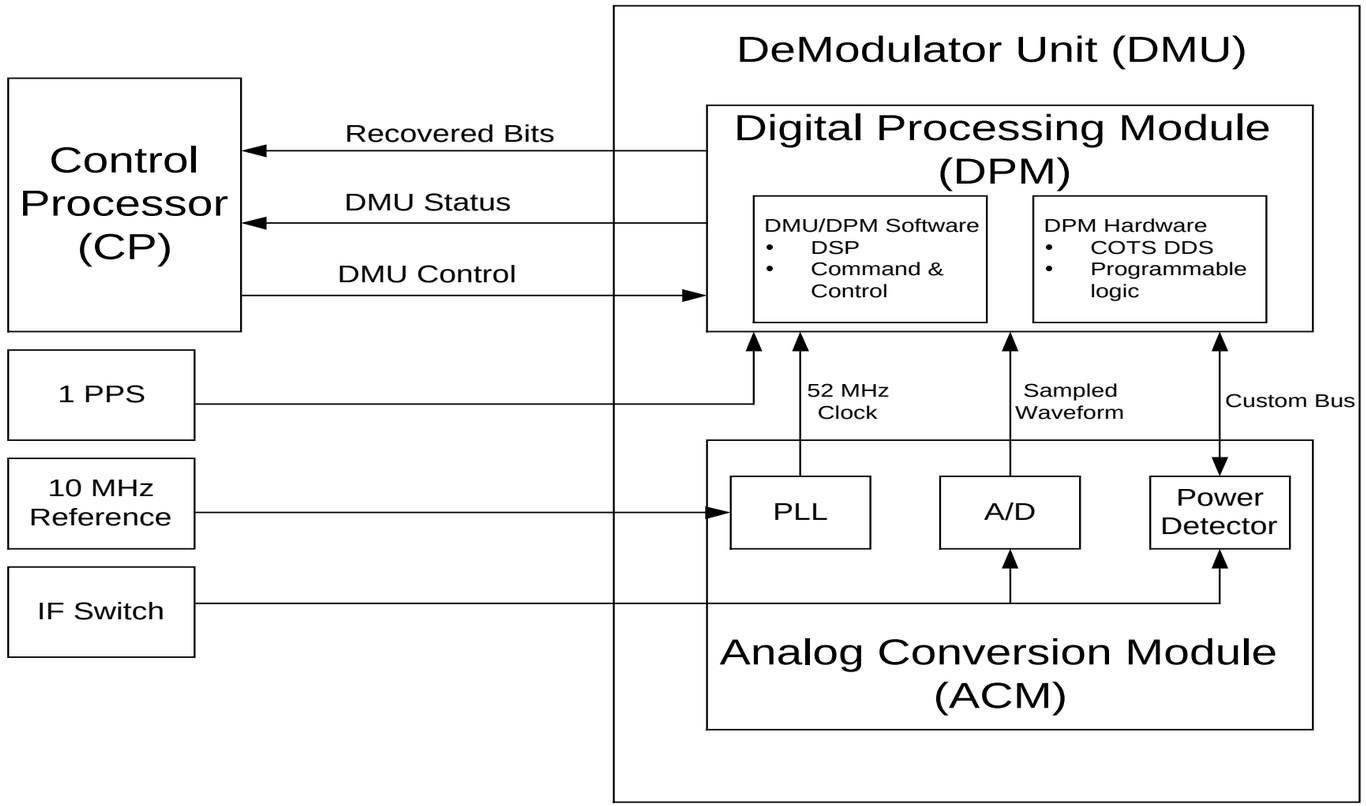
DMG Keypad

- **Allows user control and status feedback at the device itself (without DCON)**
- **Same keypad and display assembly used on the IBUG, EMC, & Fiber Optic Switch**
  - Will allow user to enter a subset of available commands and review primary status information
  - Provides a local means to execute build-in-test functions
- **Each DMU provides a basic set of status information through the use of LEDs**
  - One LED visible through the ACM faceplate to indicate a valid reference signal
  - Six LEDs available through the DPM faceplate to indicate power, fault condition, 10 MHz reference detection, PPS detection, IF signal present, and receiver lock
- **Power supplies provide good/fault status for AC power source and each supply voltage**

Key DMU Requirements

1Kbps to 150Kbps data rate range	Develop algorithms to compute low level demodulation parameters based on data rate
BPSK/PN Modulation	DAS receiver is an augmentation to an existing BPSK/PN design
Single Data Channel/SQPN	Despread I & Q codes separately and combine data coherently
Dual Data Channel/SQPN	Use two DMU cards; Assign the I channel PN code to 1 card and the Q channel PN code to the other
Variable symbol and data formats	Programmable logic code designed to accommodate these format standards
G2 Inversion	G2 symbols are “de-inverted” immediately after symbol detection.
Rate ½, K=7 encoding	Symbol decoding is COTS
Signal dynamics(+/- 114KHz & +/-114Hz/sec)	DSP controlled on board COTS tuner; Doppler correction data periodically provided by CP
Frequency uncertainty (up to +/- 4.1 KHz for carrier)	BPSK “data stripping transformation” and FFT based frequency estimator can resolve uncertainty to a few hertz.
2047 chips/cycle gold code families with 3.077799MHz chip rate	Supported by existing design
12dB SNR dynamic range	AGC circuitry (broad and narrow band) permits operation well in excess of this requirement
2.0 dB implementation loss for BER=1E-05	Worst case implementation loss for existing design was approximately 1.5dB
PN/Carrier Acquisition (90% detection in less than 3 seconds or 1 second for oscillator uncertainties of +/- 3KHz and +/-700 Hz respectively))	128 chip PNMF and FFT based frequency estimator efficient enough to meet this specification
Symbol/Decoder synchronization	Loop Bandwidths wide enough to support this criteria down to 50ms. Request exception to requirement below 50ms. Deviation request will be submitted.
Reacquisition	Receiver will re-acquire based on PN code phase and carrier frequency just prior to losing lock (see State Diagram)

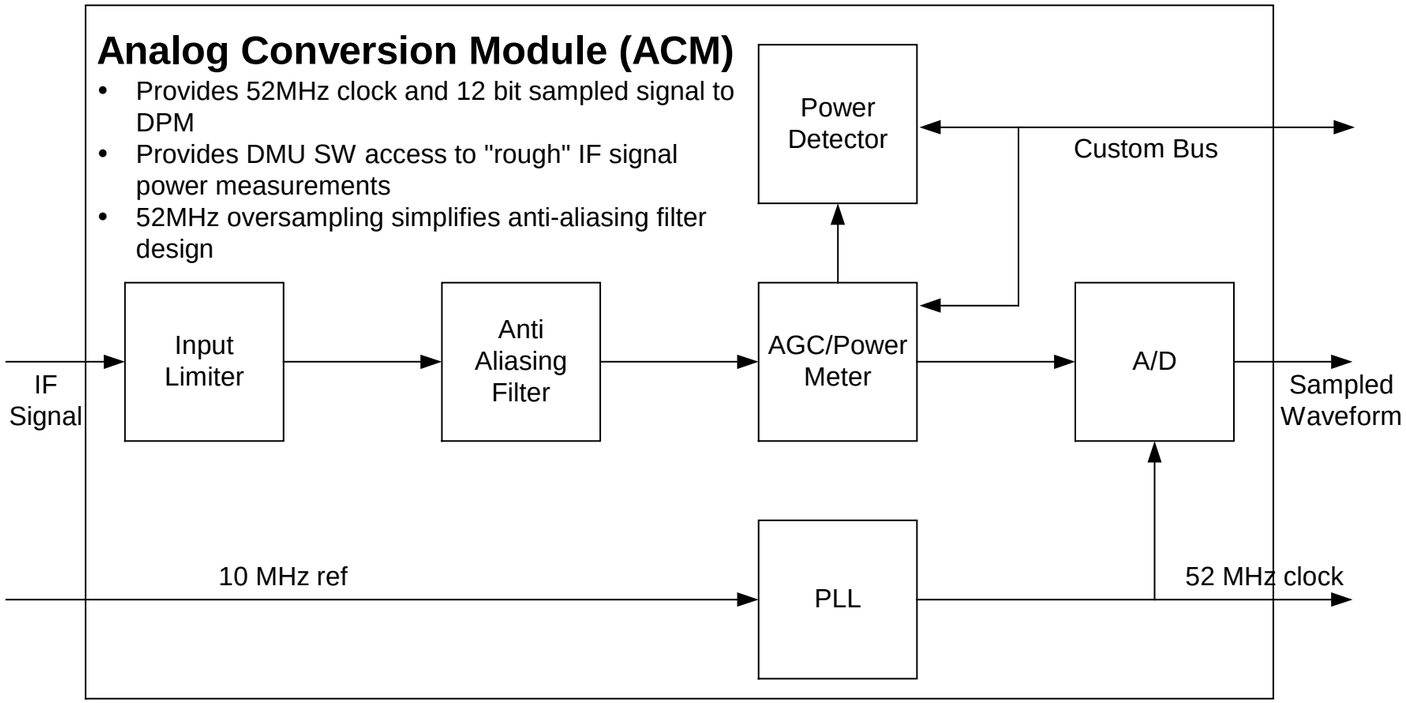
Demodulator Unit (DMU) Block Diagram



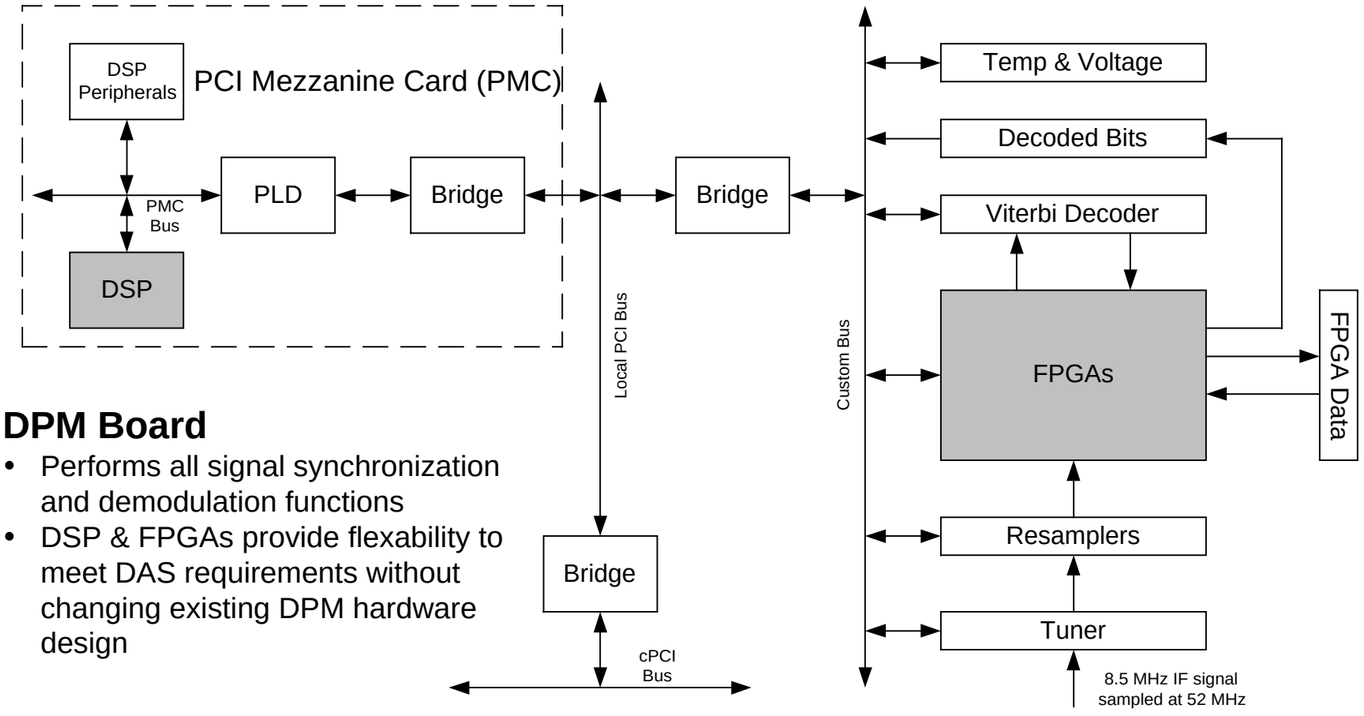
Analog Conversion Module (ACM) Block Diagram

Analog Conversion Module (ACM)

- Provides 52MHz clock and 12 bit sampled signal to DPM
- Provides DMU SW access to "rough" IF signal power measurements
- 52MHz oversampling simplifies anti-aliasing filter design



Digital Processing Module (DPM) Block Diagram

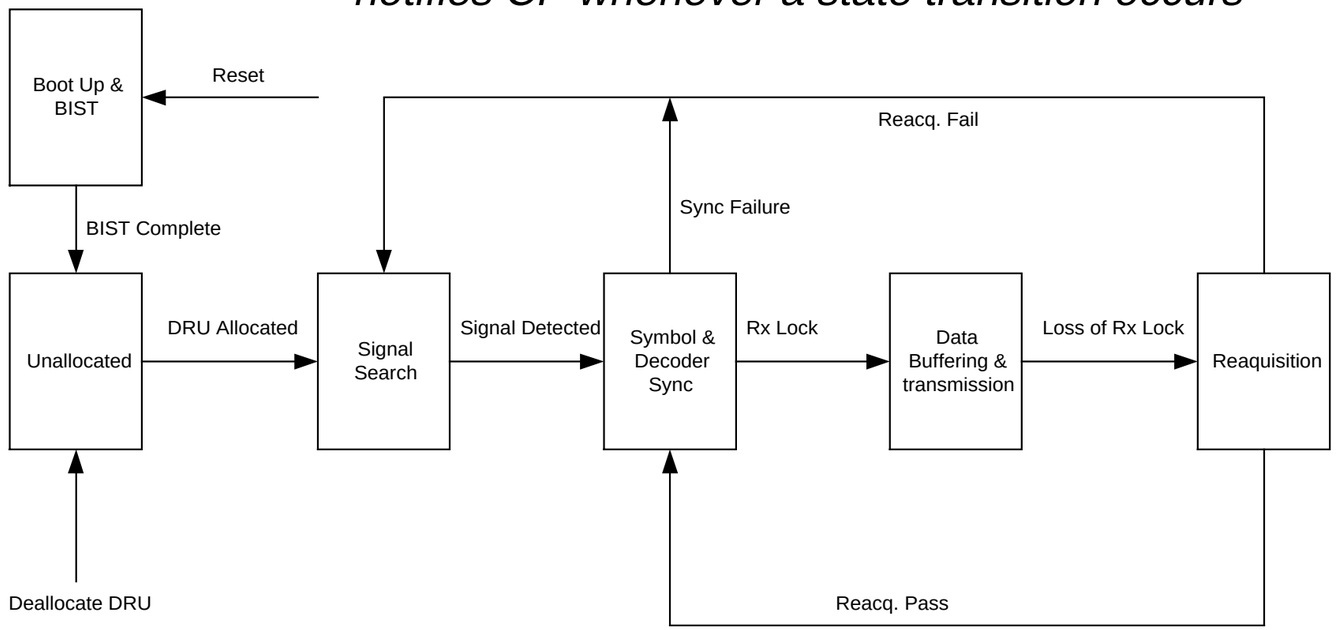


DPM Board

- Performs all signal synchronization and demodulation functions
- DSP & FPGAs provide flexability to meet DAS requirements without changing existing DPM hardware design

DMU State Diagram

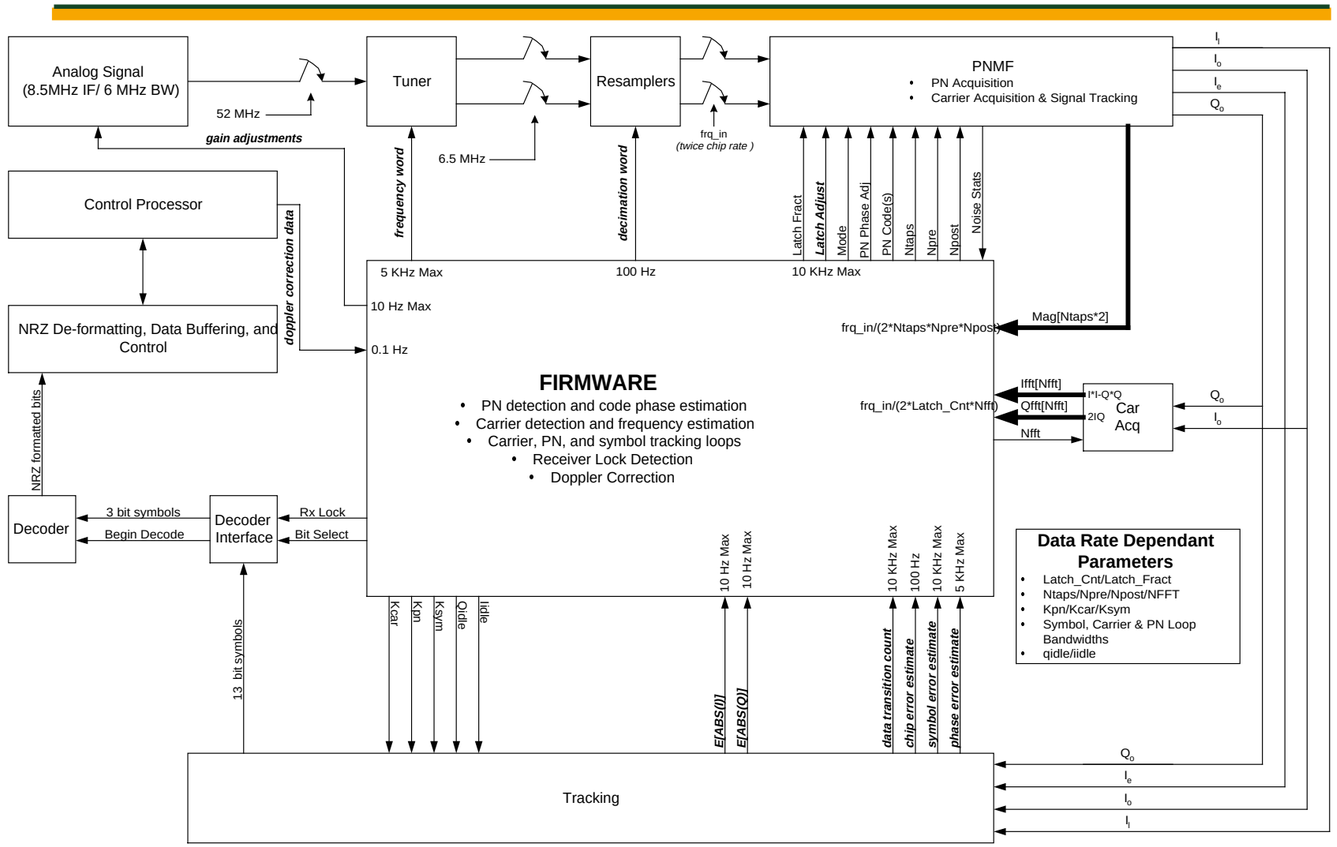
Note: DMU provides CP with current state and notifies CP whenever a state transition occurs



DMU BIST

- **Upon power up the CP and each DMU will perform self tests.**
- **The main components of the CP self test are:**
  - Connectivity to the DCON and the Data Server
  - CP to DMU communication
  - Chassis power supply voltages
  - CPCI configuration
  - CP software
  - Memory
- **The main components of the DMU self test are:**
  - 10 MHz Reference, IF Signal and 1 PPS present
  - DMU bridge configuration
  - DSP to CP and DSP to DMU Hardware communication
  - Hardware and software status
  - Temperatures and voltages
  - Memory
- **During normal operation, the CP will monitor the status of these components and periodically command un-allocated DMUs to perform BITs**

DMU Signal Processing Architecture



PN Acquisition Algorithm

- **Set size of acquisition mode correlator (data rate dependent variable a.k.a. “Ntaps”; Ntaps can be any integer between 3 and 128) and collect matched filter “magnitudes” for each of the 2*Ntaps code phases (2 samples/chip) in this PN acquisition “window”.**
- **“Npre” and “Npost” are important data rate dependent window variables that define how much averaging is done for all of the code phases within a window**
  - Npre: how many code phase samples are summed before squaring
  - Npost: how many code phase magnitudes are summed after squaring
- **Move to another window of code phases by adjusting the phase of the PN code generator. Keep moving to new windows and collecting magnitude data for each code phase until all 4094 code phases have been covered**
- **Perform a threshold test on the 4094 magnitudes. If peak magnitude is above threshold, adjust the phase of the PN generator to create a new window (a.k.a. “false alarm window”)centered about the peak position**
- **If the false alarm window peak magnitude is above a threshold and in the neighborhood of the original peak, then PN detection is declared. Peak magnitude position serves as a coarse PN code epoch estimate (to within**

PN Acquisition Performance

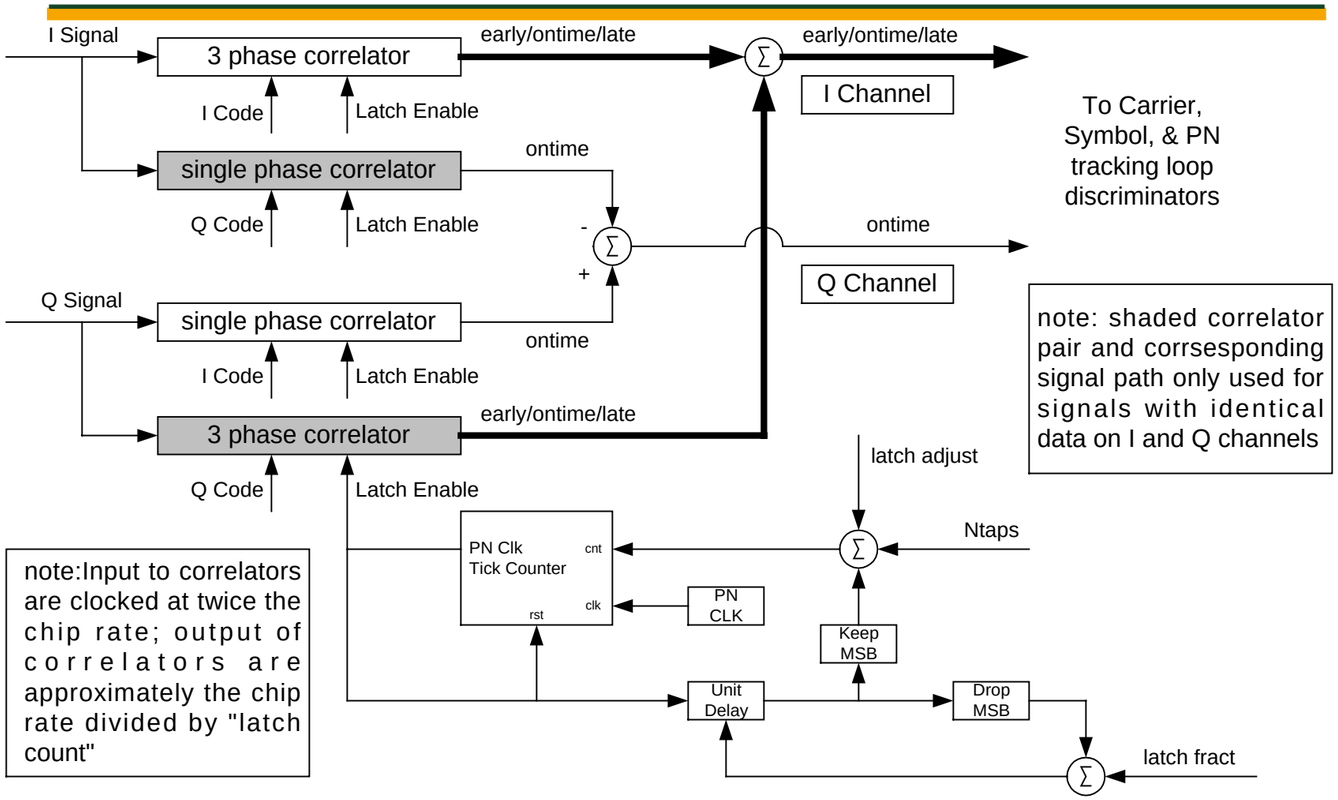
- **Worst case (1Kbps user at 1E-05 BER) parameters**
  - Coherent Integration Bandwidth (reciprocal of coherent integration time) is 3 times the one sided frequency uncertainty (1.8KHz or 4.1 KHz) or 4 times the data rate, whichever is largest
    - @1Kbps, coherent integration time is 1/(12.3KHz) or 1/(5.4KHz)
  - Ntaps = 128
  - Number of code phase windows: 16 (16*2*128=4096>4094)
  - Dwell time for a single window (applies to false alarm window as well) is ~158ms (Npost= 1905) for 4.1KHz and ~50ms (Npost=273) for 1.8KHz
- **Performance analysis given worst case parameters**
  - The probability that the signal will be properly detected (peak magnitude greater than threshold and at the correct code phase) is better than 93% for 1.8KHz uncertainty, better than 99% for 4.1KHz uncertainty
  - The probability that consecutive false detections occur in the original PN search and the FA test is less than 0.01%
  - The above statistics have 3 dB of implementation margin

Carrier Acquisition

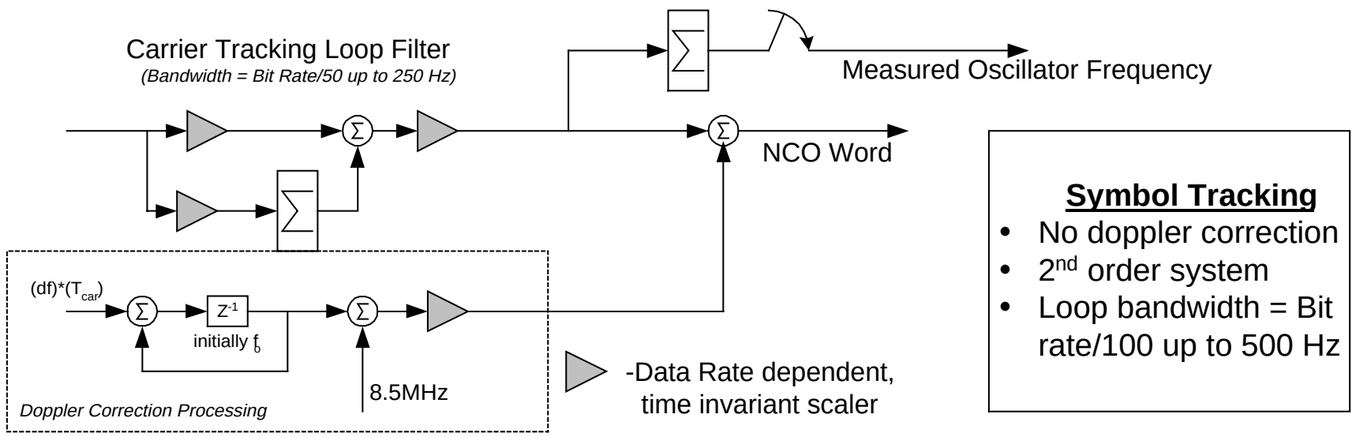
- **Set sample rate to 4 times the one sided frequency uncertainty (1.8KHz or 4.1KHz) or 4 times the data rate, whichever is greatest**
- **Perform $I^2 – Q^2$, 2IQ transformation on complex samples prior to FFT**
- **Perform complex FFT. FFT "bin" with peak magnitude corresponds to the carrier frequency**
  - FFT size depends on data rate and frequency uncertainty
  - FFT needs to be large enough to provide good detection statistics and to resolve carrier frequency uncertainty to within the tracking loop bandwidth
  - FFT size is limited by acquisition time constraints.
  - FFT sizes run from 1K (1.8KHz uncertainty, 1Kbps) to 8K (150Kbps)
- **Assuming worst case (1Kbps users @ 1E-05 BER), probability that peak magnitude bin corresponds to correct frequency is better than 99% for 1.8 KHz uncertainty and better than 98% for 4.1KHz uncertainty, with 3 dB of margin**

Taken Together, PN/Carrier Acquisition will yield better than 90% detection in less than 1 and 3 seconds for one sided frequency uncertainties of 1.8 KHz and 4.1 KHz, respectively

Front End Digital Signal Processing

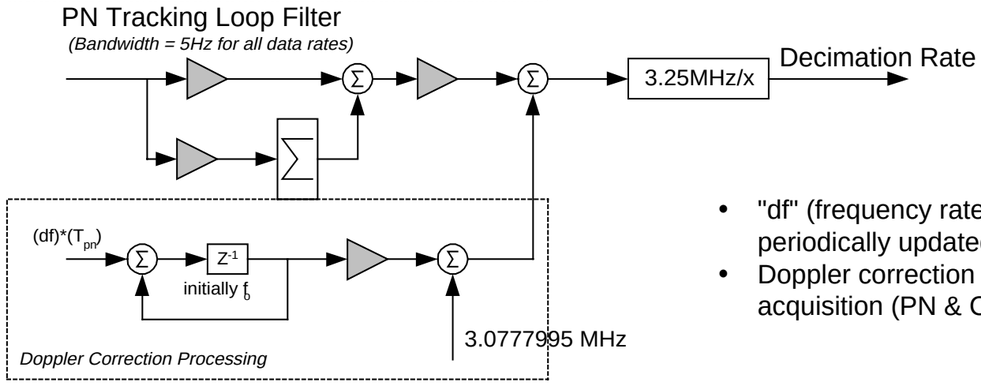


Doppler Correction and Tracking



Symbol Tracking

- No doppler correction
- 2nd order system
- Loop bandwidth = Bit rate/100 up to 500 Hz



- "df" (frequency rate) and "f_o" (frequency offset) are periodically updated.
- Doppler correction processing takes place during acquisition (PN & Carrier) and tracking

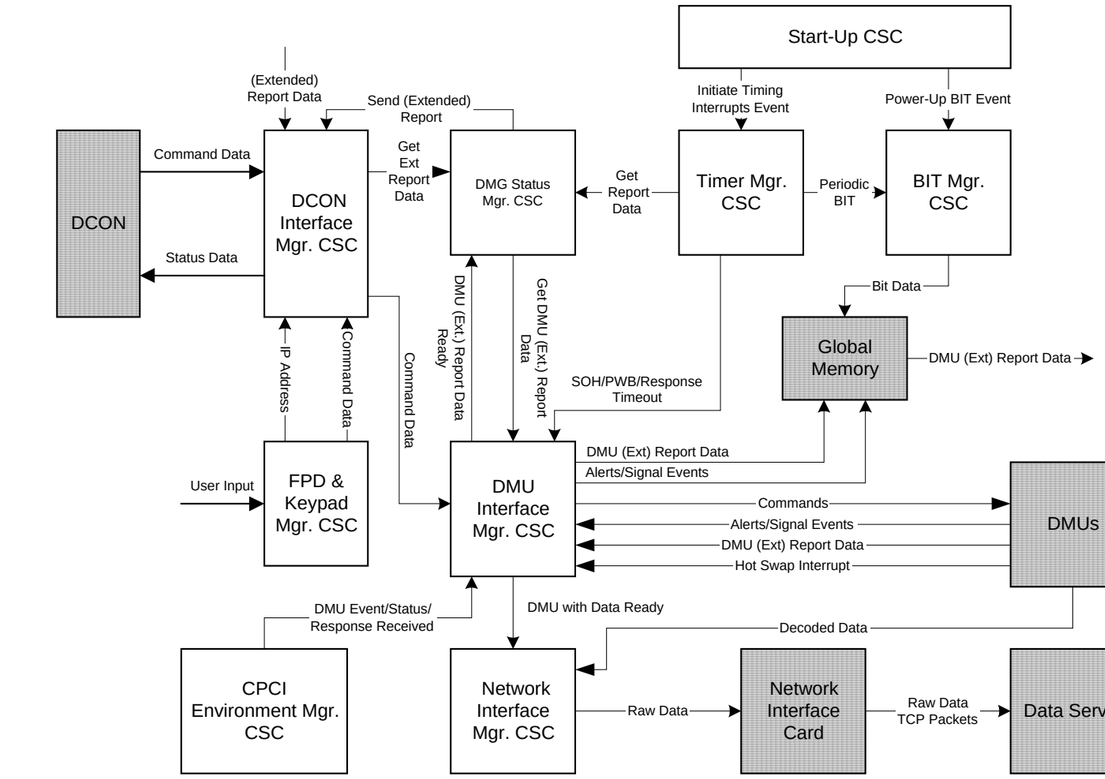
Lock Detector

- Compare E[ABS(I)] to a threshold that is proportional to E[ABS(Q)]
- First threshold estimate requires 2200 symbols (maximum allowable by SRD)
- After first threshold estimate, lock detector is updated at a 10 Hz rate
- Probability of a false lock (when E[ABS(I)] is above threshold, but no signal is present) is less than 1E-03
- Probability of a missed detection (when signal is present and tracked , but E[ABS(I)] is below threshold) is essentially zero

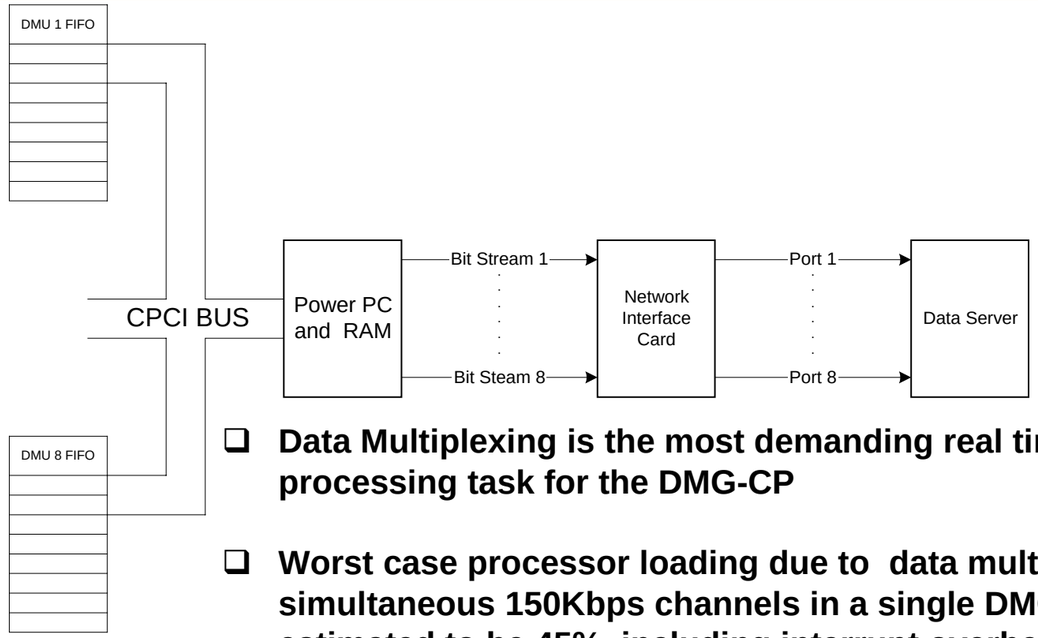
DMG Control Processor (DMG-CP)
Derived Requirements

- **Receive Doppler correction data (at a rate of once every 10 seconds) from DCON and forward to respective DMU**
- **Place DMUs in allocated or non allocated state as directed by DCON**
- **Provide for modular expandability of DMUs**
- **Configure all DMUs with their respective parameters (data rate, PN code, frequency uncertainty mode, symbol and data formats, data output port, etc.) per DCON direction**
- **Collect user data from all actively receiving DMUs and forward to data server (data multiplexing function)**
- **Provide periodic DMU status, at 1 second intervals**
  - Measured Eb/No
  - Rx Lock
  - Measured user oscillator frequency, chip rate, and data rate
  - Coarse input power (signal plus noise)
- **Monitor all DMU processing states and state transitions and**

DMG-CP CSCI Data Flow Diagram



Data Multiplexing Function



- Data Multiplexing is the most demanding real time processing task for the DMG-CP
- Worst case processor loading due to data multiplexing (8 simultaneous 150Kbps channels in a single DMG) is estimated to be 45%, including interrupt overhead
- All other less time critical CP functions expected to take less than 20% of processor time, leaving 35% of processor “idle time”

Beamformer CI
Allocated Requirements Overview

- **Functional**
  - Demux element channels from Fibre channels
  - Form beam towards assigned user position
  - Use CDB data and direction cosines to form beam
  - Null interference as directed by ICON

- **Key Performance Drivers**
  - None: Within TGBFS capability

Demand Access System (DAS)

Preliminary Design Review

26 - 27 October 2000

Day 2

“DAS – Next Generation Multiple Access Service”

PDR Agenda - Day 2

Software Design I	**10:00 – 12:00**	**Bob Smarrelli**
	LUNCH (60 mins)	
Software Design II	**13:00 – 14:00**	**Bob Smarrelli**
ITT Summary	**14:00 – 14:15**	**Walt Kearns**
	BREAK (15 mins)	
CSOC Review	**14:30 – 15:30**	
	BREAK (15 mins)	
Government Caucus	**15:30 – 16:00**	
RFA Review	**16:00 – 16:30**	

PDR Agenda

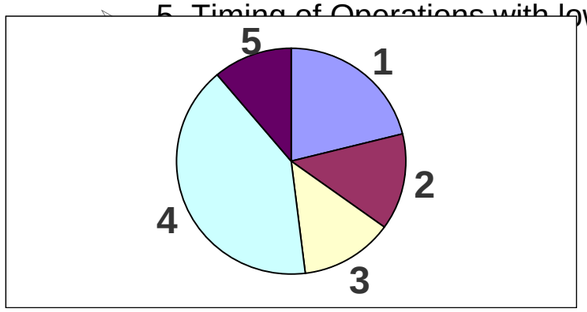
- ❑ **Program Overview**
- ➔ **System Overview**
- ❑ **Requirements Analysis**
- ❑ **System I&T and Verification**
- ❑ **Hardware Design**
- ❑ **Software Design**
  - ➢ DAS Controller (DASCON)
  - ➢ Archive/Server (DSER)
  - ➢ DMG Controller (DCON)
  - ➢ ICON (Upgrade)
  - ➢ ECON (Upgrade)
  - ➢ Requirements Traceability Matrices
- ❑ **Summary**

DAS Controller CI (DASCON) Allocated Requirements Overview (1 of 2)

- **Functional Overview**
  - Overall DAS System Controller
  - Coordinates user service scheduling and equipment resource allocation
  - Provides Operator local MMI Provides customer interface
  - Interfaces to the WSC SN systems, SWSI, ECON, ICON, DCON, Data Archive Server
- **Key Drivers**
  - Maintain multiple configuration sets for each user
  - Maintain multiple real-time status logs
  - Establish visibility windows
  - Implement near real time allocation-modification requests from users
  - Dynamically allocate pooled equipment/resources to support user return service

DAS Controller CI (DASCON) Allocated Requirements Overview (2 of 2)

- **Key functional requirements within DASCON CI are:**
  - 1. Customer Interaction Management
  - 2. DAS Resource Management (Status, Availability, and Allocation)
  - 3. DAS State Vector Data Management
  - 4. DAS Operations and Control
    - - WSC SN System Interface Control
    - - DAS Operations Control
    - - System Resource and Customer Data Status Updates
  - 5. Timing of Operations with lower level controllers (ICON, DCON, ECON)



Relative number of functional requirements allocated to the five areas noted above

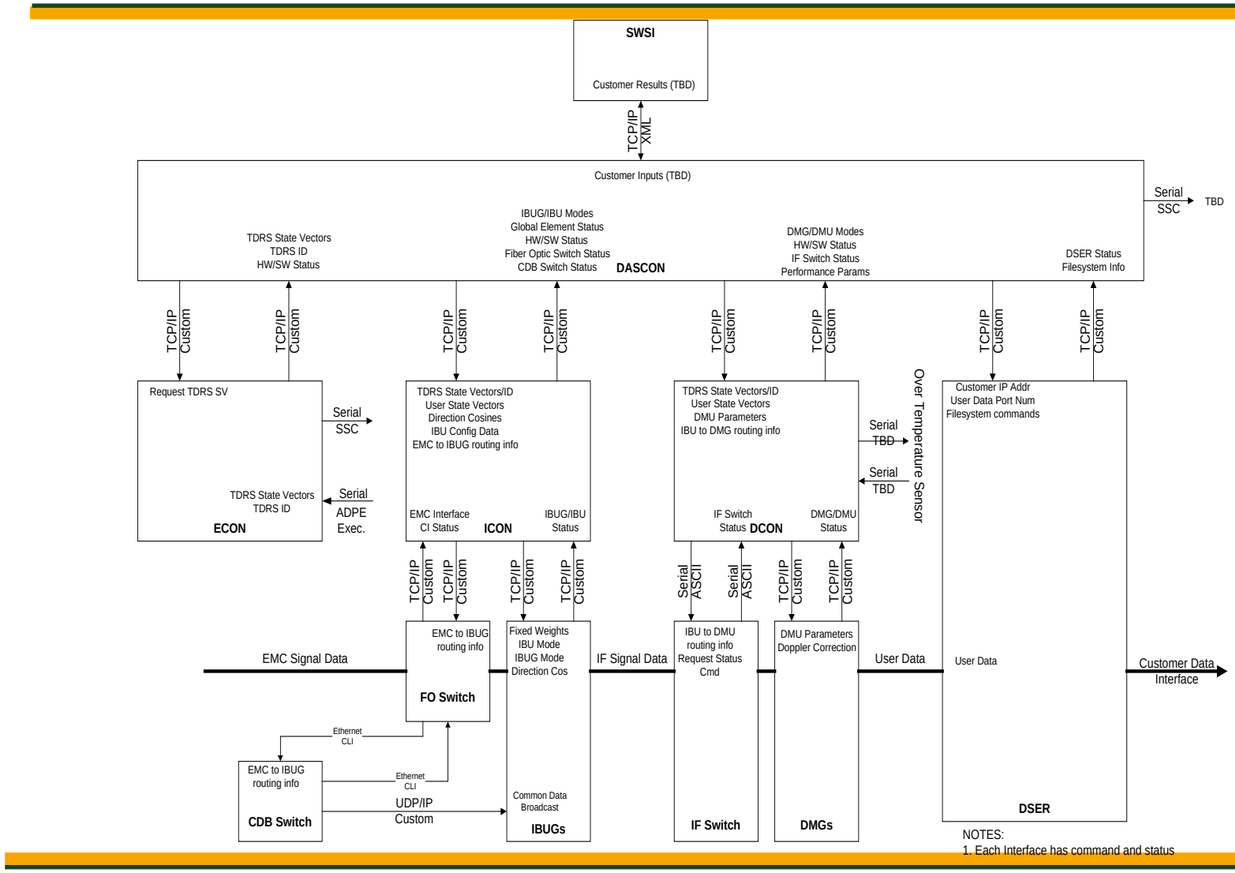
DASCON CSCI Design Overview (1 of 2)

- Multi-threaded application runs under Red Hat Linux
- Resides on a Pentium III based, 19” rack mounted PC
- Provides operator with graphical user interface to control/configure the entire DAS
- Collects status from the ECONs, ICONs, DCONs and DSERs via a 10 base T Ethernet interface using TCP/IP protocol
- Graphically displays the received status and health information.
- Accepts Customer information from and provides customer feedback to SWSI
- Manages DAS resource allocation and schedules
- Utilizes Oracle 8i as the database engine to log status, maintain customer information and resource management
- Calculates visibility windows to determine resource switching and allocation

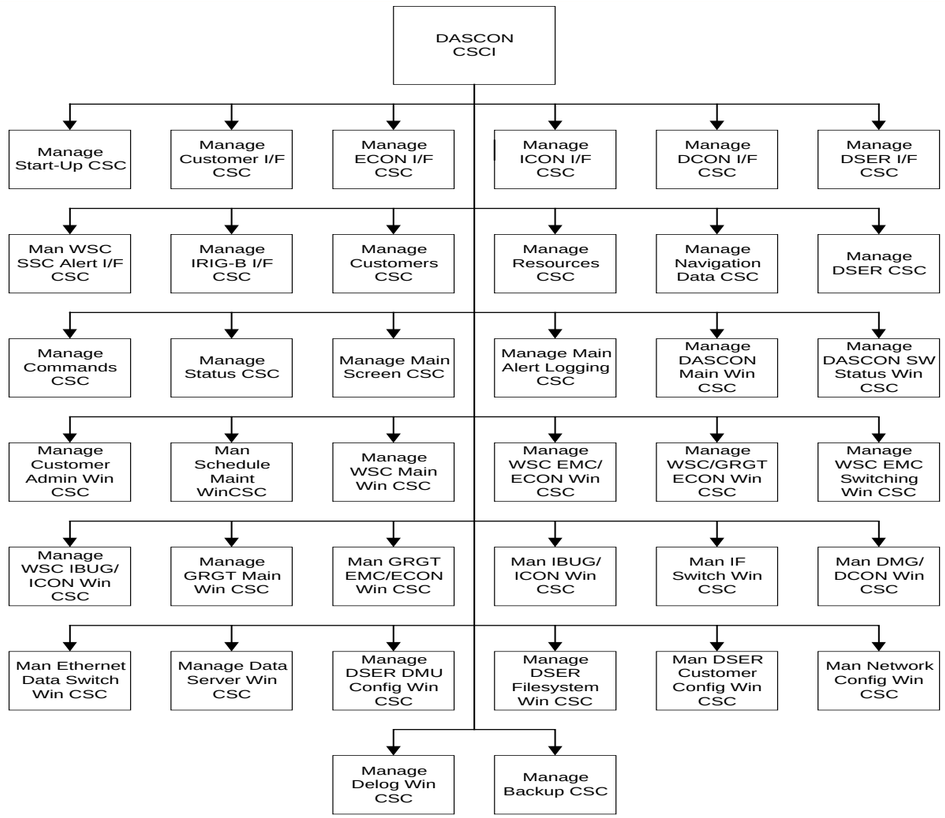
DASCON CSCI Design Overview (2 of 2)

- Allows delogging of individual status measurands
- Sends a “go/no-go” indication based on DAS status, to the WSC TOCC via an RS449 connection to the CTFS SSC.

DASCON CSCI Design Interfaces

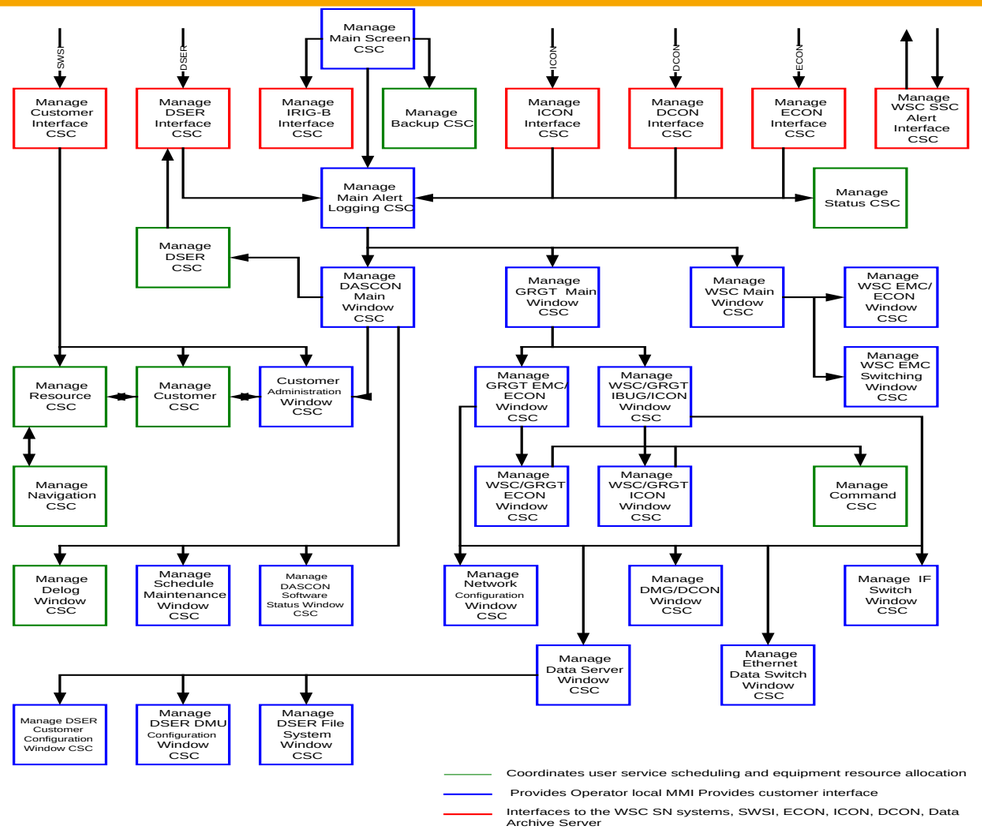


DASCON CSCI Design Hierarchy

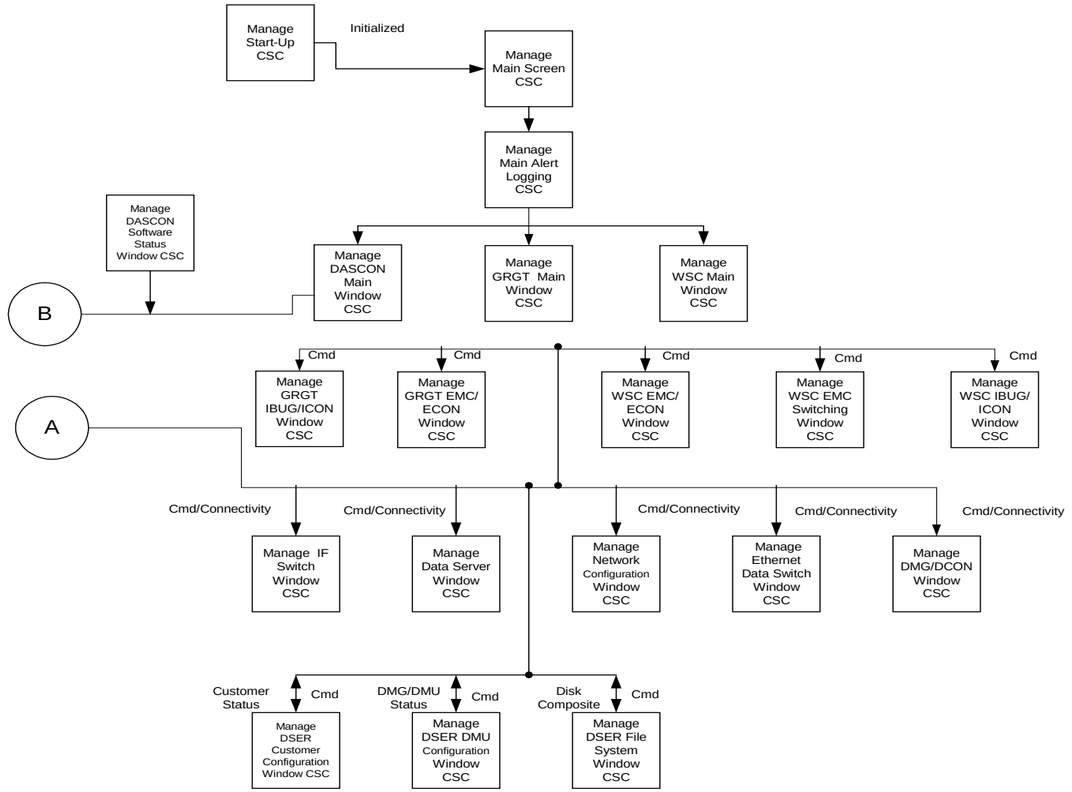


DASCON CSCI Design

Processing Flow

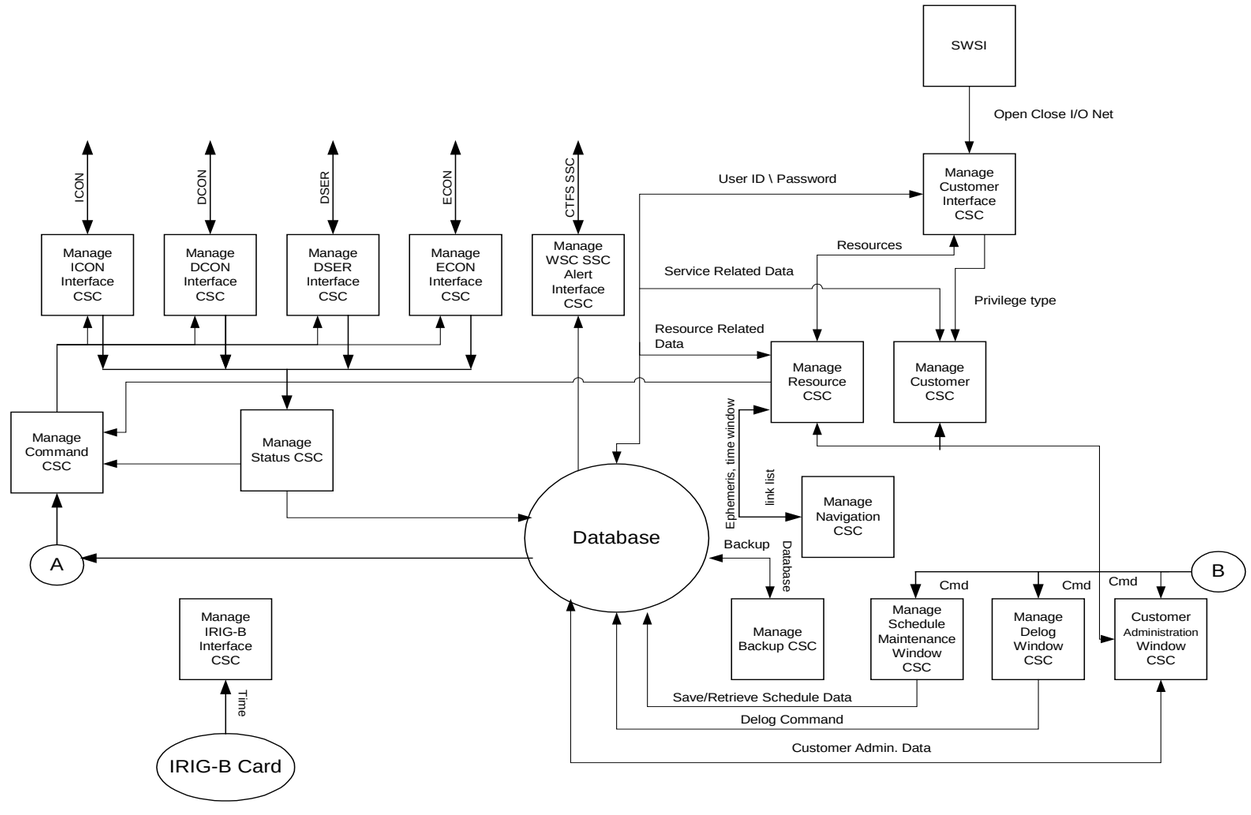


DASCON CSCI Design
Data Flow



DASCON CSCI Design

Data Flow

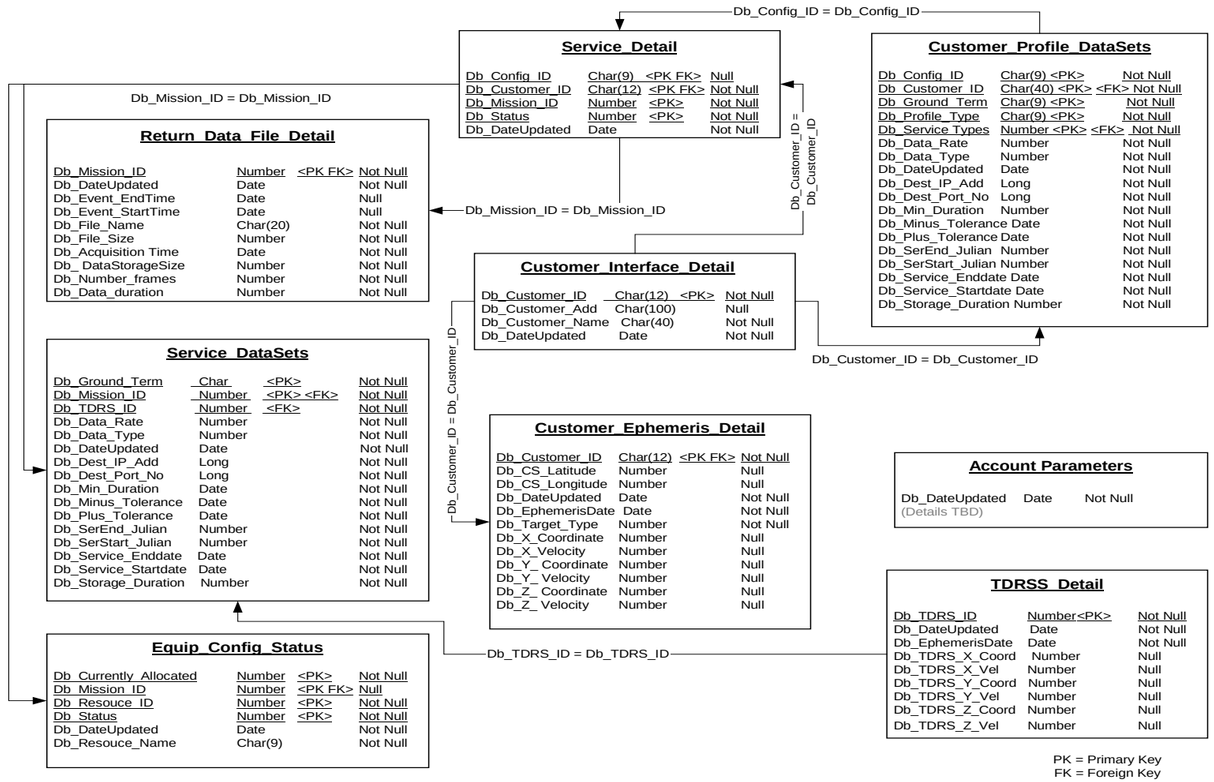


DASCON CSCI Design
Database Design

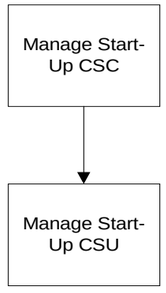
Table Name	Description
Accounting_Statistics	This table stores service accounting parameters.
Customer_Profile_DataSets	This table saves the customers configuration data. There can be up to ten (10) sets of configuration parameters saved for each customer.
Customer_Ephemeris_Detail	This table saves the customers ephemeris data. Depending on the target type either the coordinate or velocity fields will be populated.
Customer_Interface_Detail	This table saves the customers related data.
Equip_Config_Status	This table saves the status of the resources which is send to DASCON from the other DAS sub systems
Return_Data_File_Detail	This table saves storage information about the return data file
Service_Config_DataSets	This table saves all the resources allocated to a Mission_ID.
Service_Detail	This table saves the details associated with each service.
TDRSS_Detail	This table stores TDRS(s) related information.

DASCON CSCI Design

Database Design

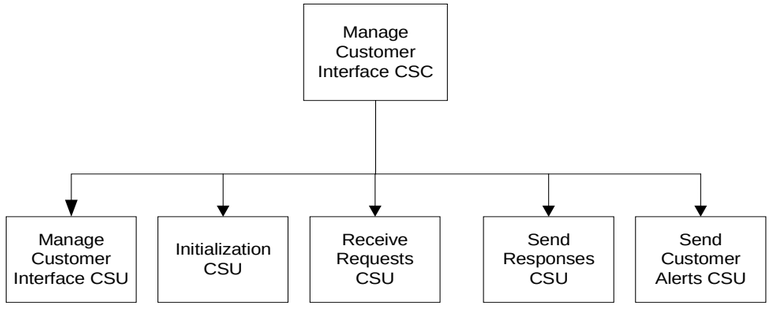


DASCON CSCI Design
Manage Start-Up CSC



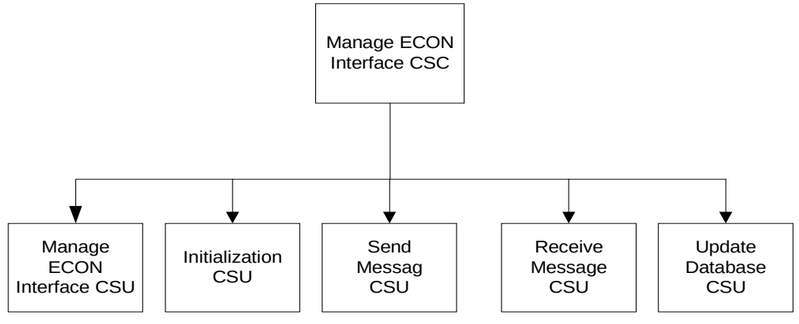
- Performs all variable initializations
- Controls initial thread creation

DASCON CSCI Design
Manage Customer Interface CSC



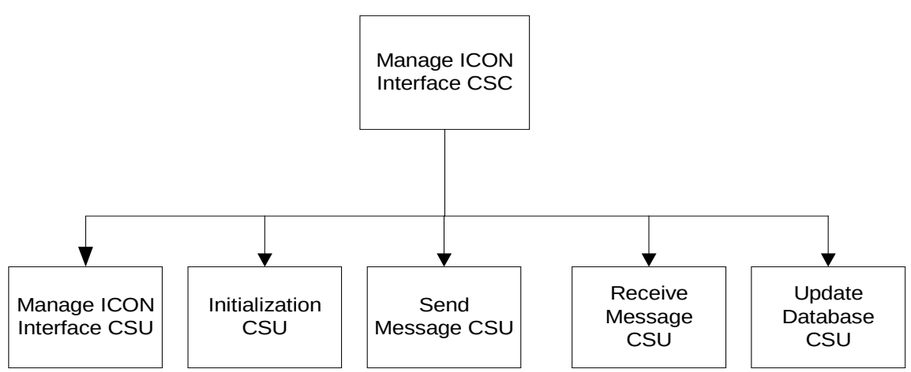
- Handles all interactions between the SWSI and the DAS
- Interactions include handling resource allocations requests, providing resource allocation planning information, submitting resource allocation request decisions, managing customer archived data, managing customer accounts and sending customer alerts.

DASCON CSCI Design
Manage ECON Interface CSC



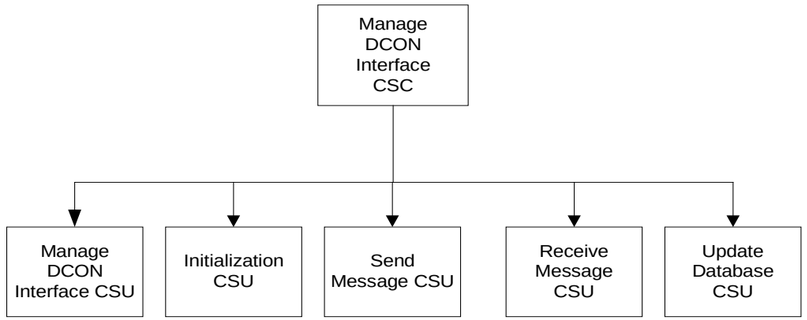
- **Manages the interface between the DASCON and the ECONs**
- **Interface includes commands sent to the ECONs, status received from the ECONs as well as receiving TDRS state vector data as defined in the DAS-WSC ICD.**

DASCON CSCI Design
Manage ICON Interface CSC



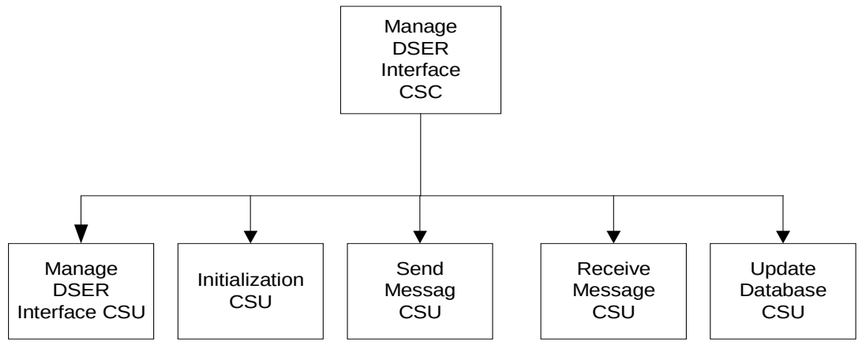
- Manages the interface between the DASCON and the ICONs
- Interface includes commands sent to the ICONs, status received from the ICONS and sending TDRS State Vectors to the ICONs as defined in the DAS Internal ICD

DASCON CSCI Design
Manage DCON Interface CSC



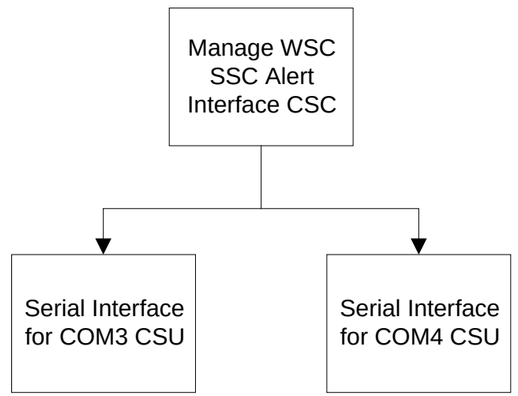
- Manages the interface between the DASCON and the DCONs
- Interface includes commands sent to the DCONs, status received from the DCONS and sending TDRS State Vectors to the DCONs as defined in the DAS Internal ICD

DASCON CSCI Design
Manage DSER Interface CSC



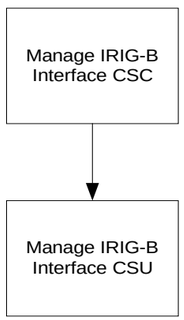
- **Manage interface between DSER and DASCON**

DASCON CSCI Design
Manage WSC SSC Alert Interface CSC



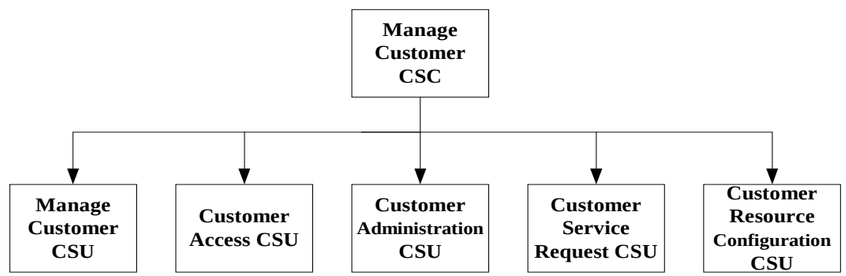
- **Configure the RS449 serial port to establish the communication between the CTFS SSC and DASCON**
- **Receives the system status request from SSC, then send a “go/no-go” status to the CTFS SSC**

DASCON CSCI Design
Manage IRIG-B Interface CSC



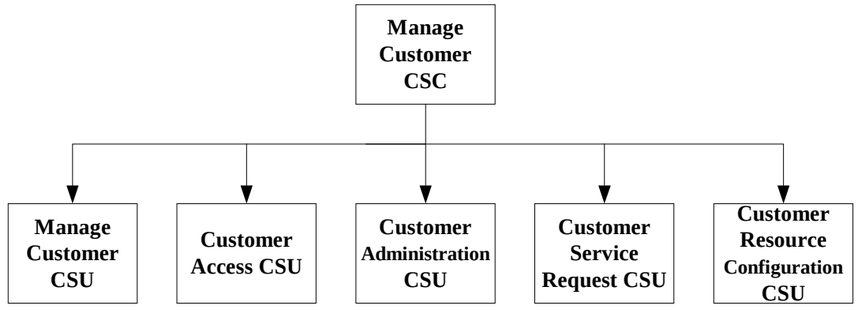
- **The Manage IRIG-B CSC manages the IRIG-B Card to maintain the GMT time on the DASCON system.**

DASCON CSCI Design
Manage Customer CSC



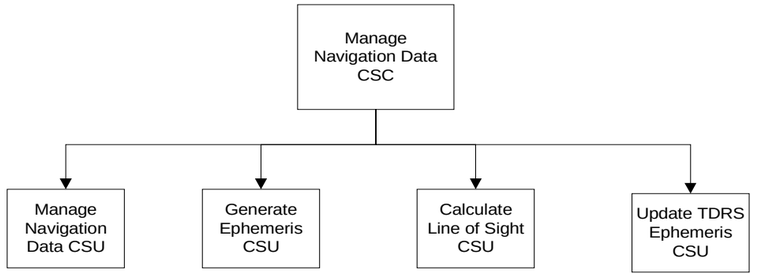
- Will authenticate all customer access and report all unauthorized access attempts to the DAS LCM.
- Only authorized personnel will be allowed to input, access and delete DAS Customer authorization data.
- Customers will provide resource allocation requests to the DAS and receive resource allocation reports from the DAS.
- DAS Customers will have the capability of entering, storing, updating, and retrieving constant parameters that are included routinely in requests for resource allocations. This information will be automatically retrieved and attached to a resource allocation request.

DASCON CSCI Design
Manage Resources CSC



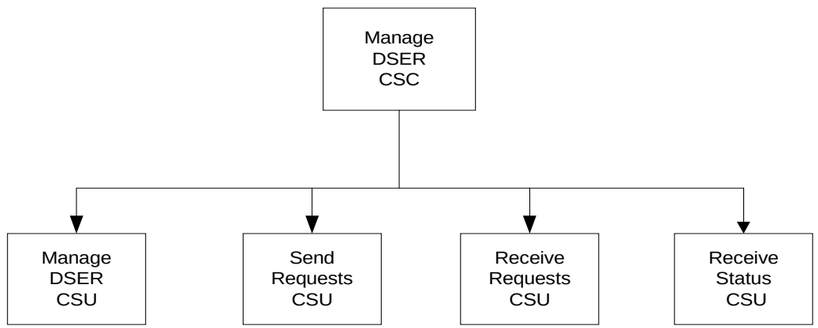
- The Manage Resources CSC provides resource configuration and automated management of resources by determining resource availability.
- Resource availability is determined not only by reserved usage of beamformers and demodulators but also by Customer emitter/TDRS visibility opportunities and dedicated vs. non-dedicated shared users.
- This CSC also manages resource re-allocation/maintenance by trying to reschedule resources and sending message alerts to customers whose services have been modified.

DASCON CSCI Design
Manage Navigation Data CSC



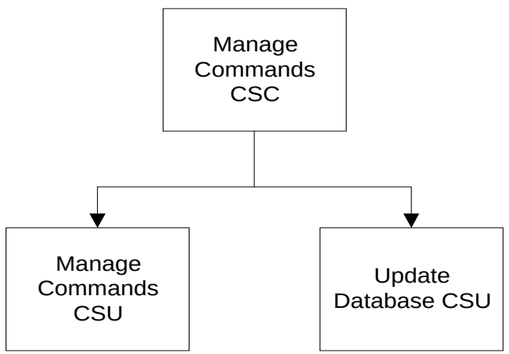
- The Manage Navigation Data CSC calculates the ephemeris data for both the TDRS and orbiting customers using a J2 orbit propagation model.
- The coordinates (Lat/Long) for stationary customers will be converted to the Earth Centered Inertial (ECI) coordinate system.
- Calculates visibility windows for each customer for the appropriate TDRSs.
- Stores ephemeris data stored for TDRS is stored up to 96 hours.
- The customer's ephemeris data will not be stored (used for planning only)

DASCON CSCI Design
Manage DSER CSC



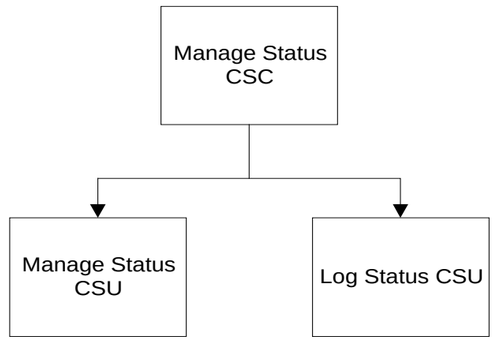
- **Manage and orchestrate data retrieval, data purge, data distribution, data archiving, and status administration**

DASCON CSCI Design
Manage Commands CSC



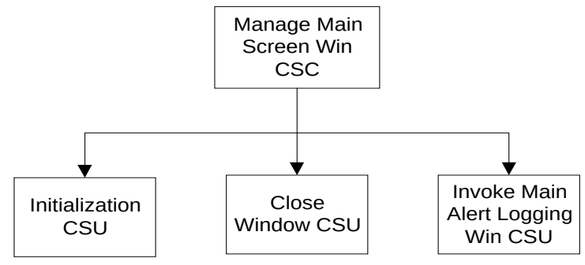
- **Handles all the commands sent from any GUI screen including updating the database and tasking the commands**

DASCON CSCI Design
Manage Status CSC



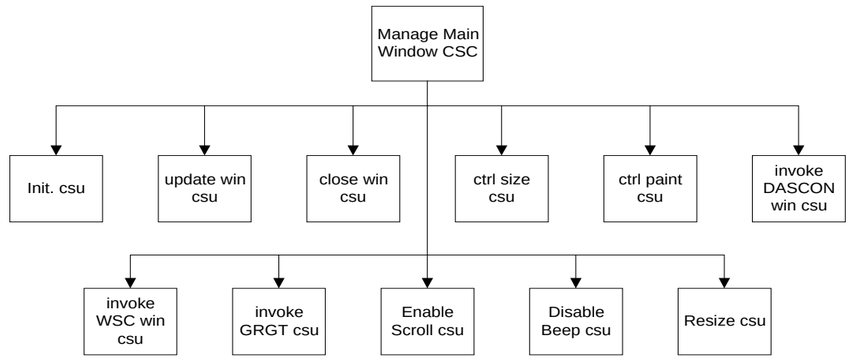
- **Collects and logs all DAS system status from the DASCON Interface CSCs (ECON, ICON, DCON, DSER)**

DASCON CSCI Design
Manage Main Screen CSC



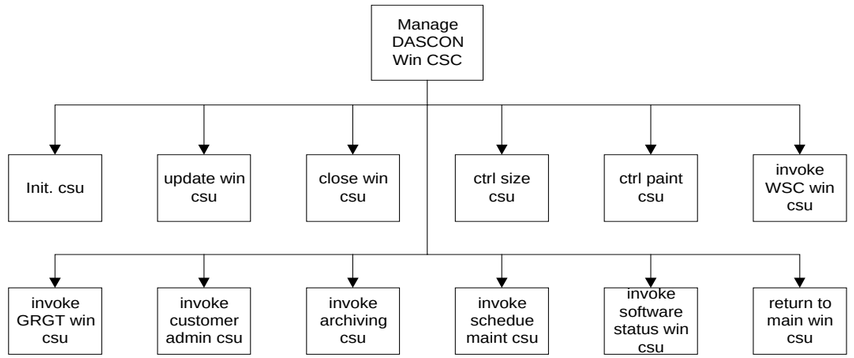
- **Main/root CSC of the DASCON**
- **Initiates execution of the GUI and background processes**

DASCON CSCI Design
Manage Main Alert Logging Window CSC



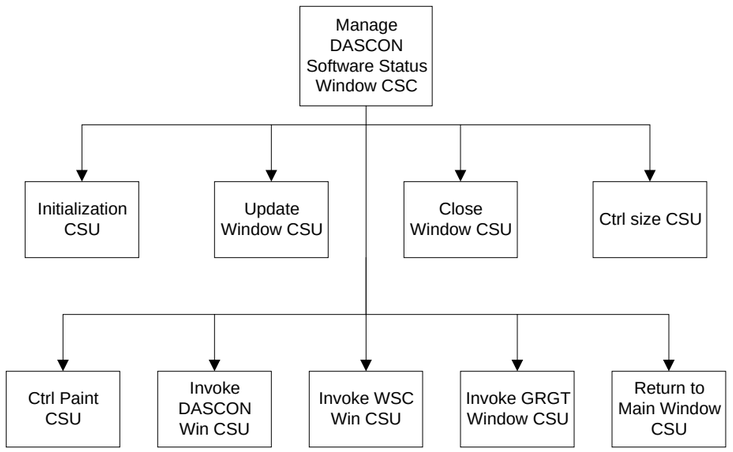
- Displays high level status for DASCON, WSC, Guam, and the I/O Net.
- Displays real-time alerts and information in the alert window
- Status is updated once per second.

DASCON CSCI Design
Manage DASCON Main Window CSC



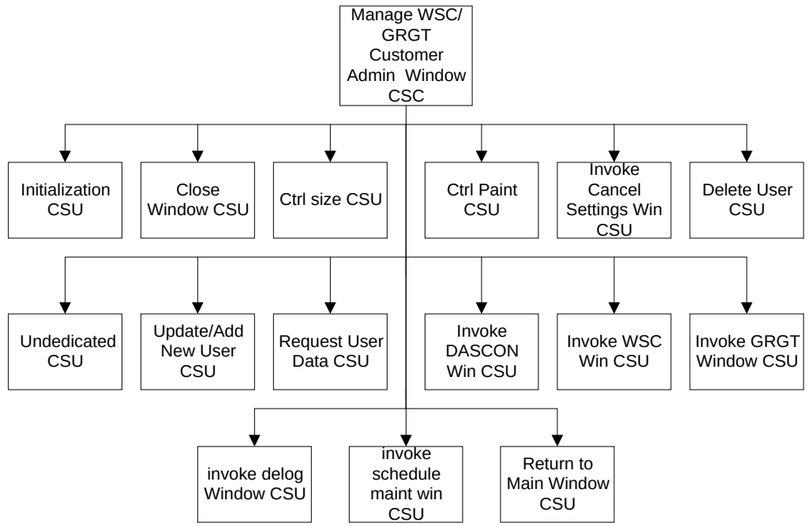
- **Displays the connectivity of the five ECONs, the two ICONs (WSC/GRGT), the two DCONs (WSC/GRGT), the two DSERs (WSC/GRGT), the customer interface (SWSI), the I/O Net, GDIS to the DAS and the status of the DASCON software and Power Supply.**
- **Status is updated once per second.**

DASCON CSCI Design
Manage DASCON Software Status Win CSC



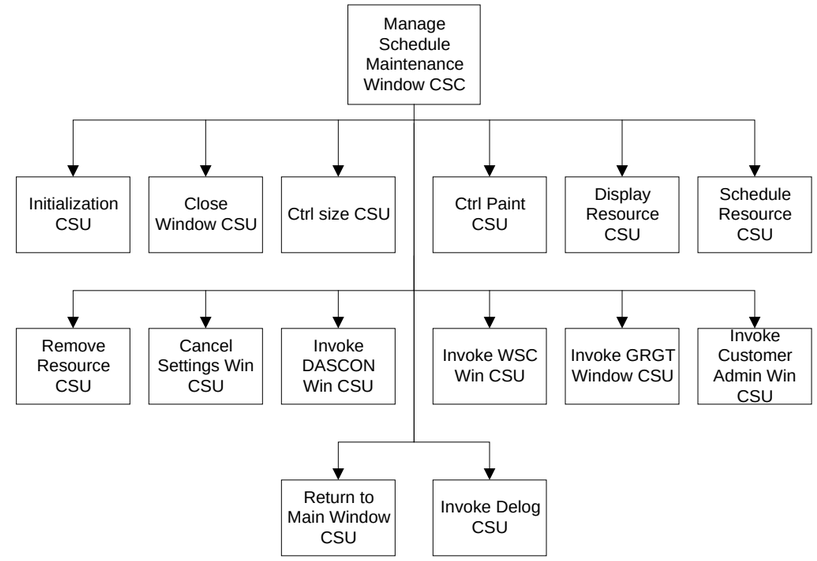
- Displays the status of the DASCON software including software faults, operating system faults, as well as task faults.
- Status is updated once per second.

DASCON CSCI Design
Manage Customer Administration Win CSC



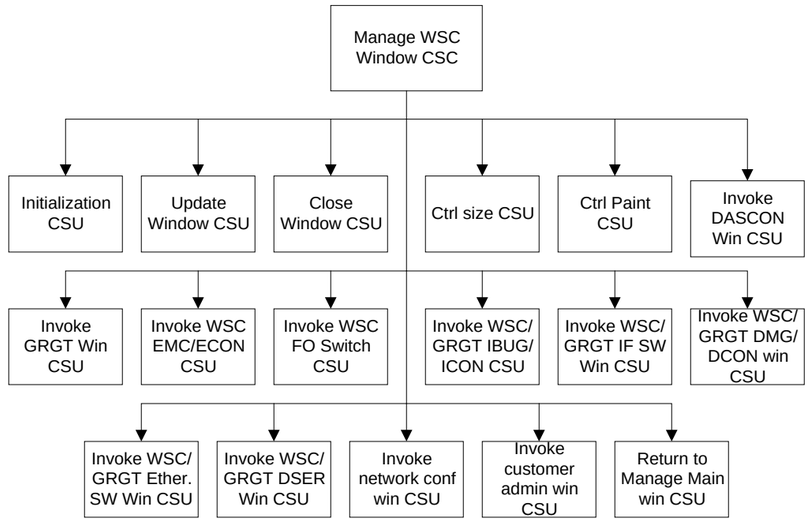
- Displays and allows operators to administer customer information, such as adding and delete users, changing a user's password, etc.

DASCON CSCI Design
Manage Schedule Maintenance Win CSC



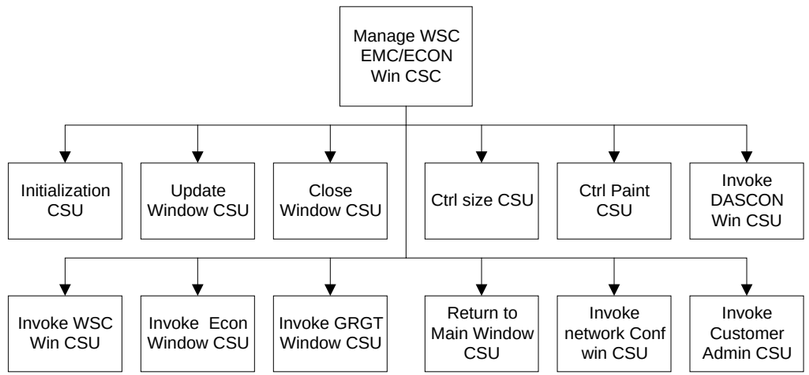
- Displays the cumulative resource usage of the DASCON per SGLT.
- Allows the operator to reserve time on a SGLT for PM and/or testing

DASCON CSCI Design
Manage WSC Main Window CSC



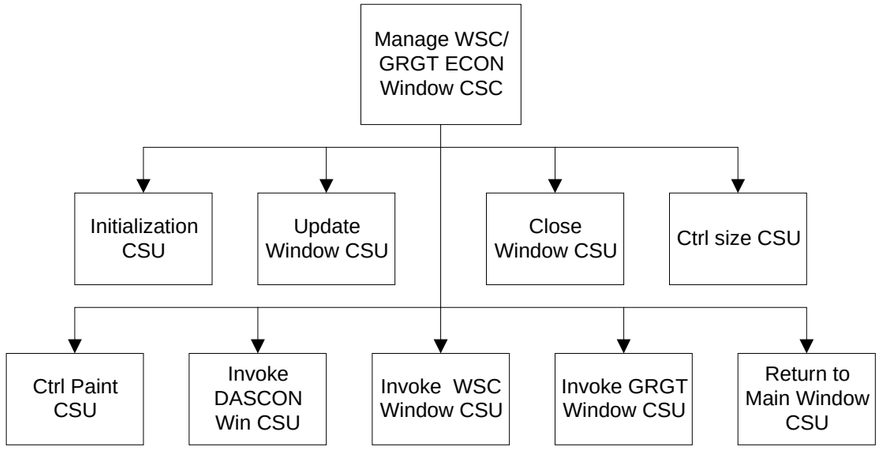
- ❑ **Displays the high level status of the DAS System at WSGT/STGT.**
- ❑ **Status is updated once per second.**

DASCON CSCI Design
Manage WSC EMC/ECON Window CSC



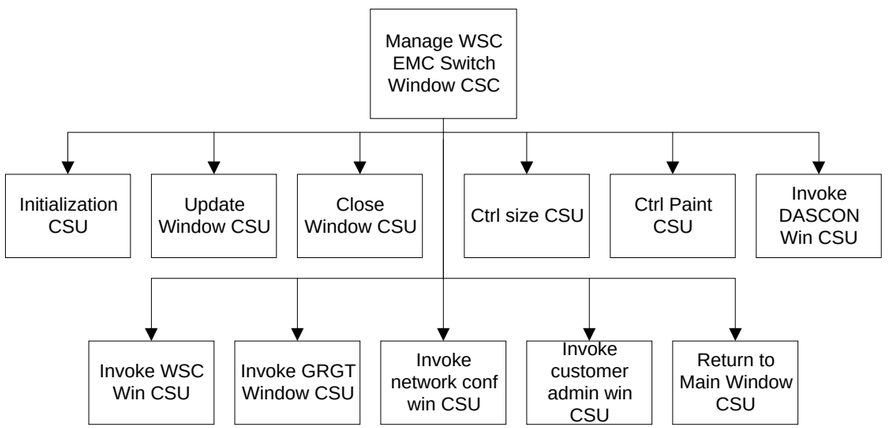
- Displays the operational status of the ECON and the 4 EMCs at WSGT/STGT as well as the EMC TDRS assignment and connectivity to the ADPE interfaces to receive TDRS state vectors.
- This window is unique to the WSC location and not a dual purpose window such as the IF Switch Window.
- Status is updated once per second.

DASCON CSCI Design
Manage WSC/GRGT ECON Window CSC



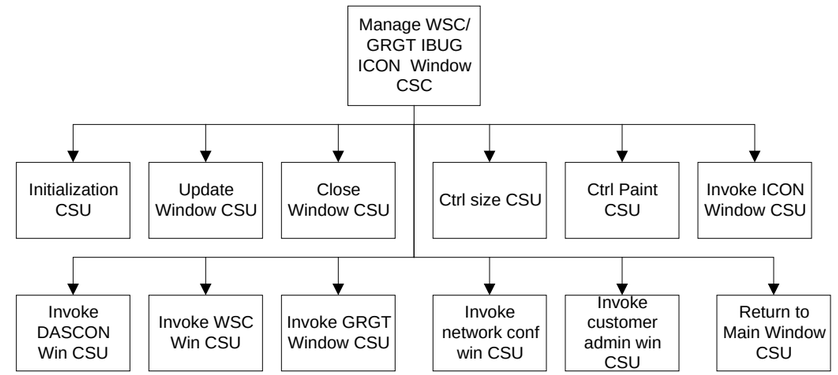
- ❑ **Displays the ECON Status.**
- ❑ **Status is updated once per second.**

DASCON CSCI Design
Manage WSC EMC Switching Window CSC



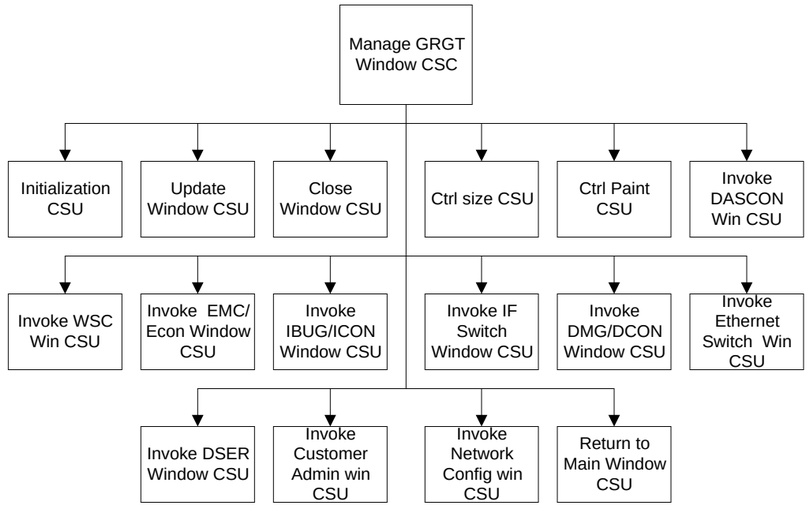
- Displays the operational status of the Fiber Optic Switch and the Common Data Broadcast Switch of the EMC Interface CI.
- This window is unique to the WSC location and not a dual purpose window such as the IF Switch Window.

DASCON CSCI Design
Manage WSC IBUG/ICON Window CSC



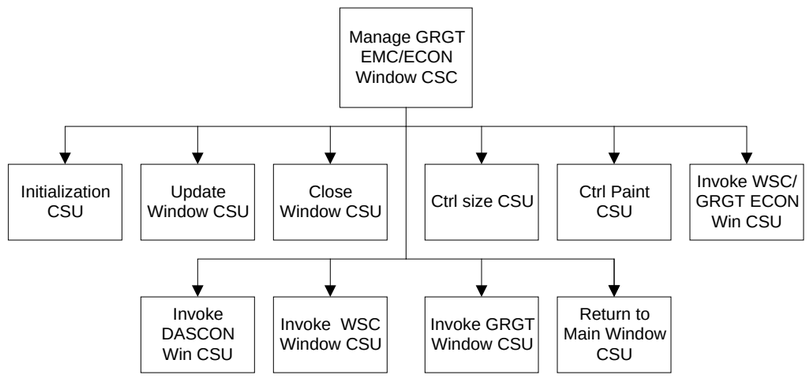
- ❑ **Display the operational status of the ICON and up to ten IBUGs.**
- ❑ **Status is updated once per second.**
- ❑ **Invoke other CSCs (windows).**

DASCON CSCI Design
Manage GRGT Main Window CSC



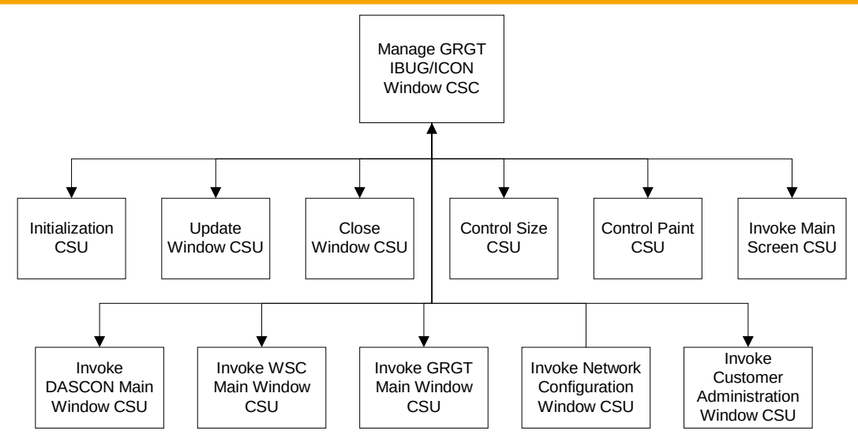
- ❑ **Displays the main status of the DAS System at GRGT.**
- ❑ **Status is updated once per second.**

DASCON CSCI Design
Manage GRGT EMC/ECON Window CSC



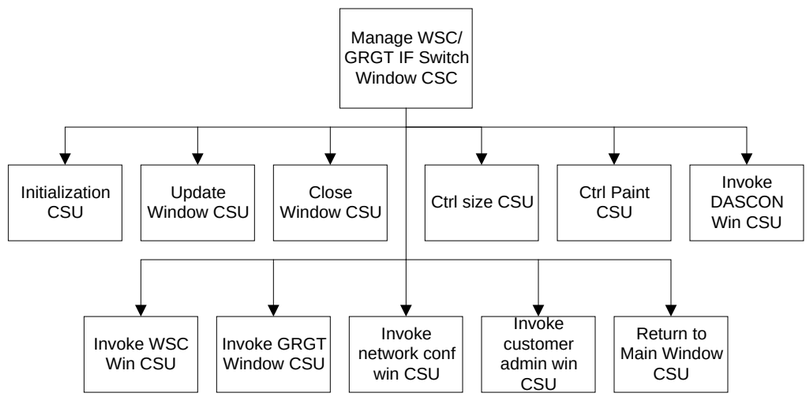
- Displays the operational status of the ECON and the EMC at GRGT.
- This window is unique to the GRGT location and not a dual purpose window such as the IF Switch Window.
- Status is updated once per second.

DASCON CSCI Design
Manage GRGT IBUG/ICON Window CSC



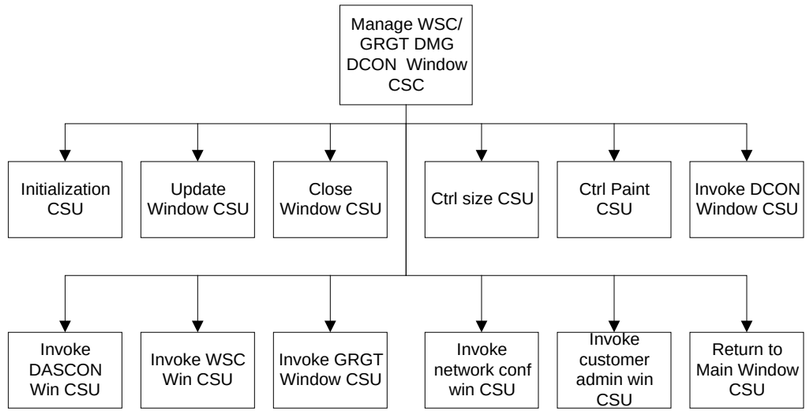
- ❑ **The Manage GRGT IBUG/ICON Window CSC will show the operational status of the ICON and up to ten IBUGs.**
- ❑ **Status is updated once per second.**

DASCON CSCI Design
Manage WSC/GRGT IF Switch Window CSC



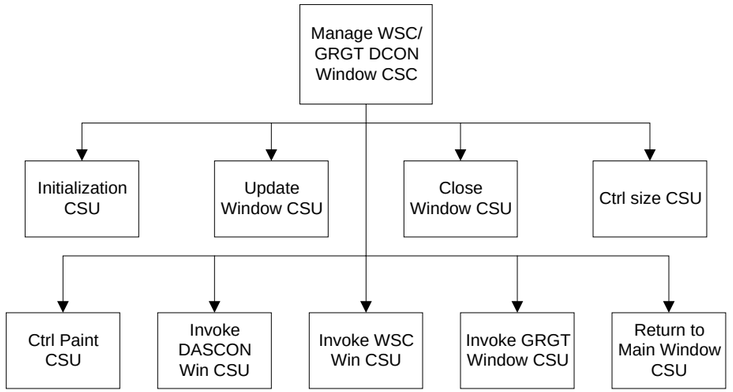
- **Displays the operational status of the IF Switch at either WSGT/STGT or GRGT.**
- **Status is updated once per second.**

DASCON CSCI Design
Manage WSC/GRGT DMG/DCON Window CSC



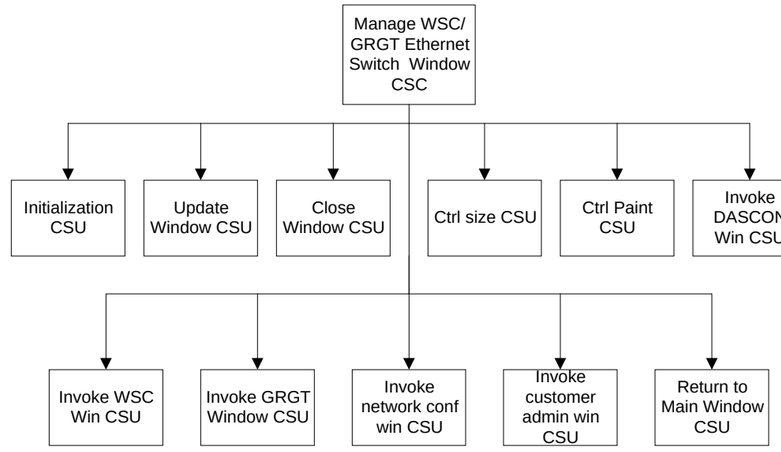
- Displays the operational status of the DCON and up to eight DMGs at either WSGT or GRGT.
- Status is updated once per second.

DASCON CSCI Design
Manage WSC/GRGT DCON Window CSC



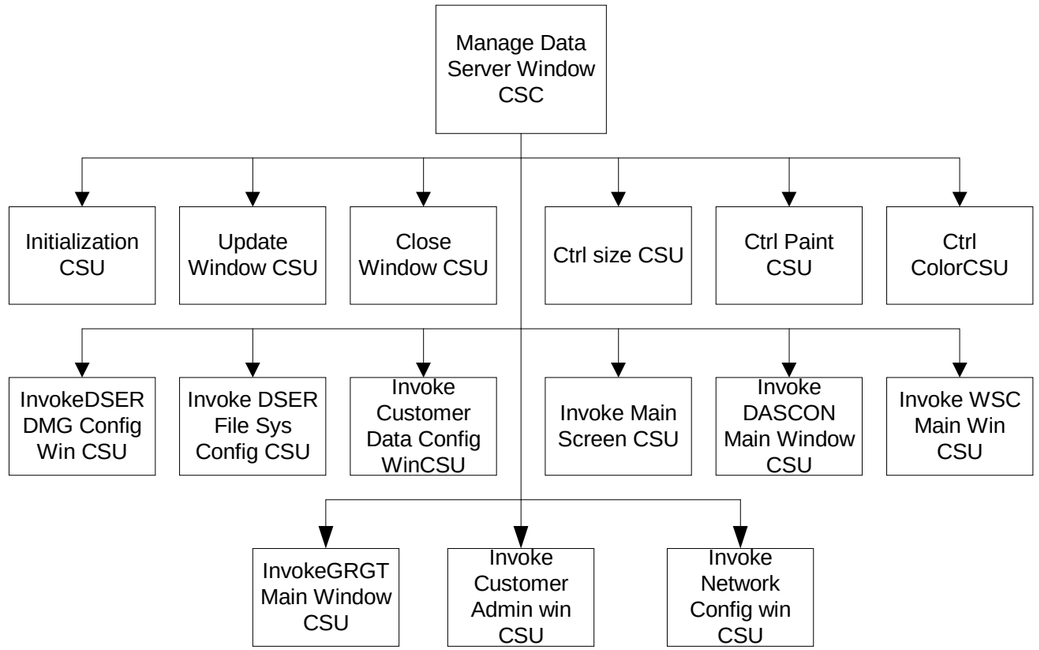
- **Display the status of the DCON at WSGT or GRGT.**
- **Status updated once per second.**

DASCON CSCI Design
Man WSC/GRGT Ethernet Data Switch Win CSC



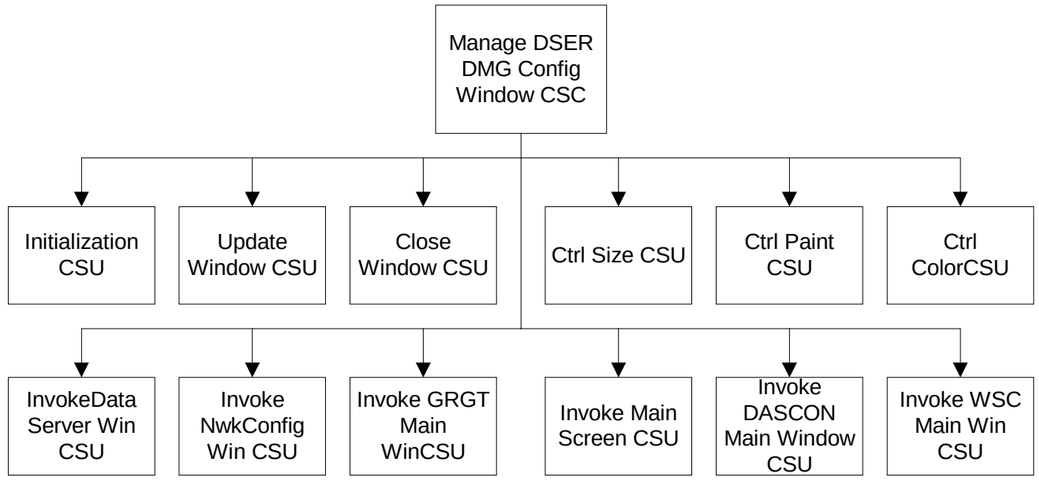
- **Displays the operational status of the Ethernet Data Switch between the DMGs and the DSER at either WSGT or GRGT.**
- **Status is updated once per second.**

DASCON CSCI Design
Manage Data Server Window CSC



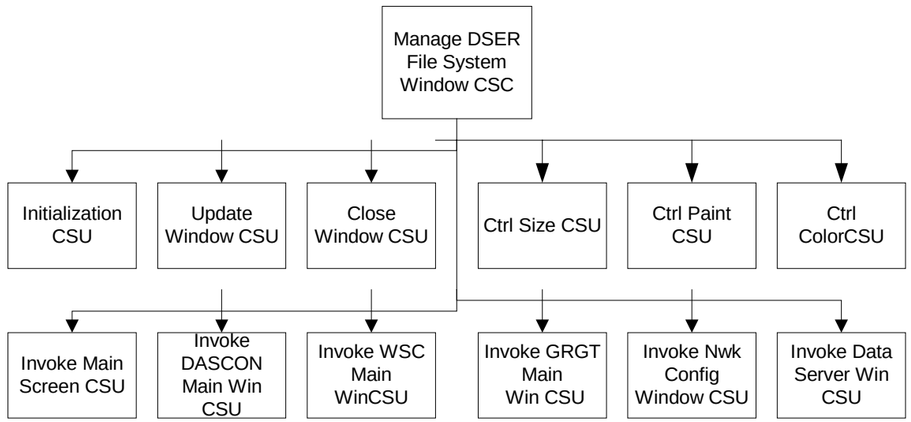
- **Serves as the main DSER window that shows the operational status both at WSGT and GRGT.**

DASCON CSCI Design
Manage DSER DMG Config Window CSC



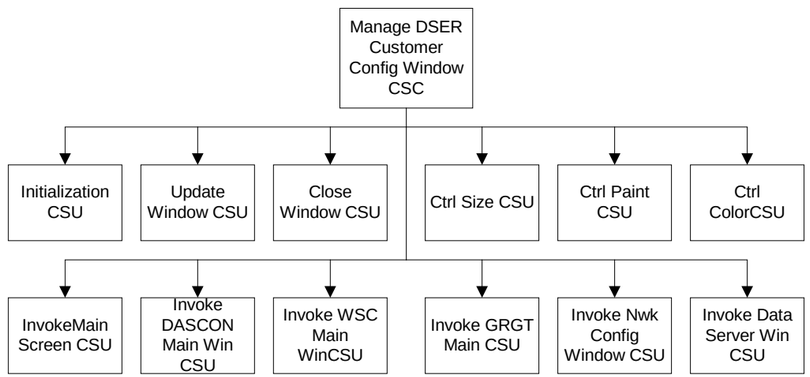
- Displays operational status of a given DMG/DMU

DASCON CSCI Design
Manage DSER Filesystem Window CSC



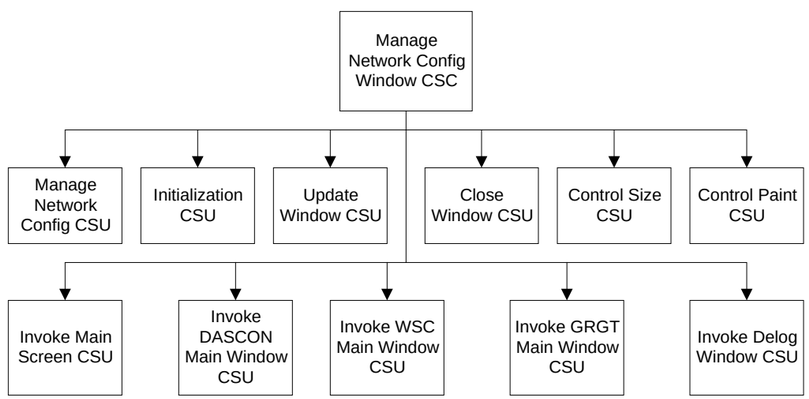
- Displays disk storage and provides interaction to purge/retrieve data files

DASCON CSCI Design
Manage DSER Customer Config Window CSC



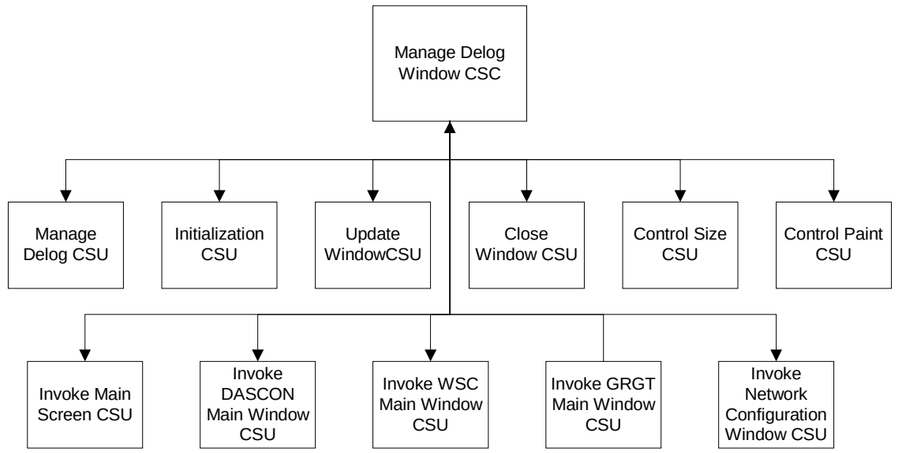
- Displays operational status of Customers

DASCON CSCI Design
Manage Network Configuration Window CSC



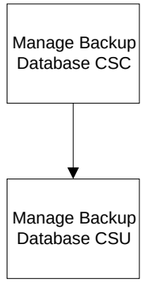
- **Will open and initialize a window to allow the configuration of the IP addresses for connection to the ECON(s), ICON, DCON, DSER at either WSGT or GRGT.**

DASCON CSCI Design
Manage Delog CSC



- The Manage Delog Window CSC allows the operator to delog information contained in the database.
- The results of the search are written to a file specified by the operator.

DASCON CSCI Design
Manage Backup Database CSC



- **Backs up the current database for archiving, once per day.**

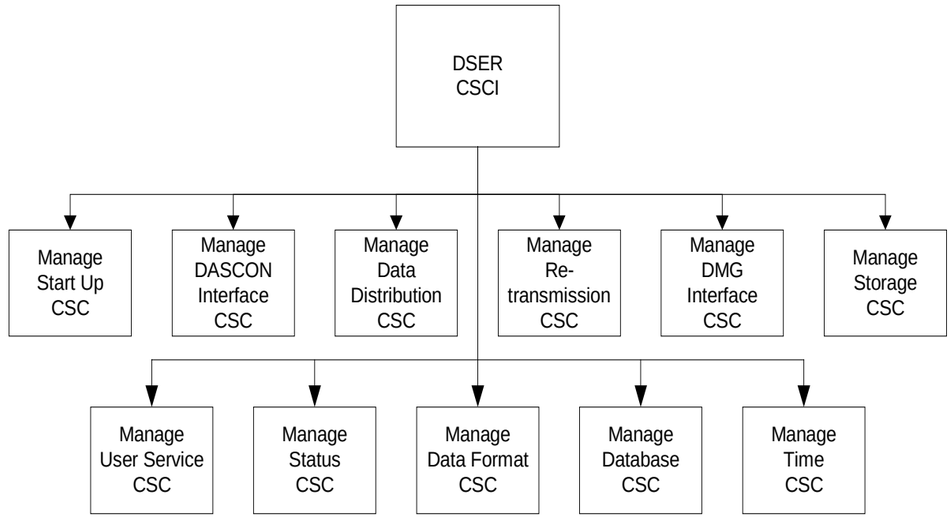
Data Archive/Server CI (DSER) Requirements Overview

- **Functional**
  - Provide data formatting
  - Route all user data appropriately
  - Provide a mechanism for data loss recovery and non-real time data access
  - Interfaces to the DMU, I/O Net and DASCON
- **Key Drivers**
  - Near real-time retrieval of archived data in response to user request
  - Provide return data for multiple simultaneous users
  - Archive return data for multiple simultaneous users
  - Support WDIS data formats

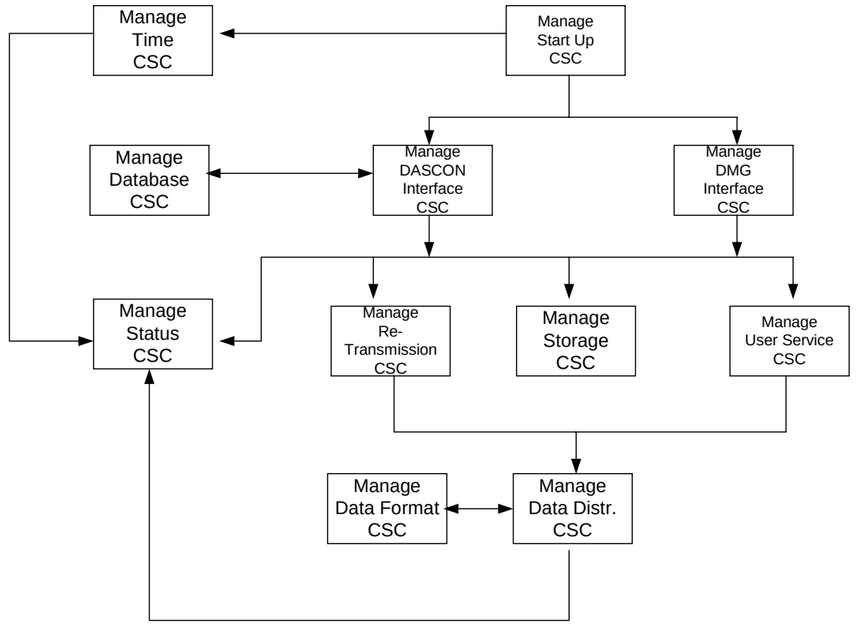
DSER CSCI Design Overview

- Multi-threaded application runs under Red Hat Linux
- Resides on a Pentium III based, 19” rack mounted PC
- Provides operator with a graphical user interface to view DMG/DMU and customer operational status
- Utilizes Python Pickle as a database engine to log current DSER configuration state
- Passes status information to the DAS Controller
- Accepts control and configuration commands from the DAS Controller
- Supports WDIS return data formats and protocol
- Automatic purging of data files when disk exceeds 95% capacity

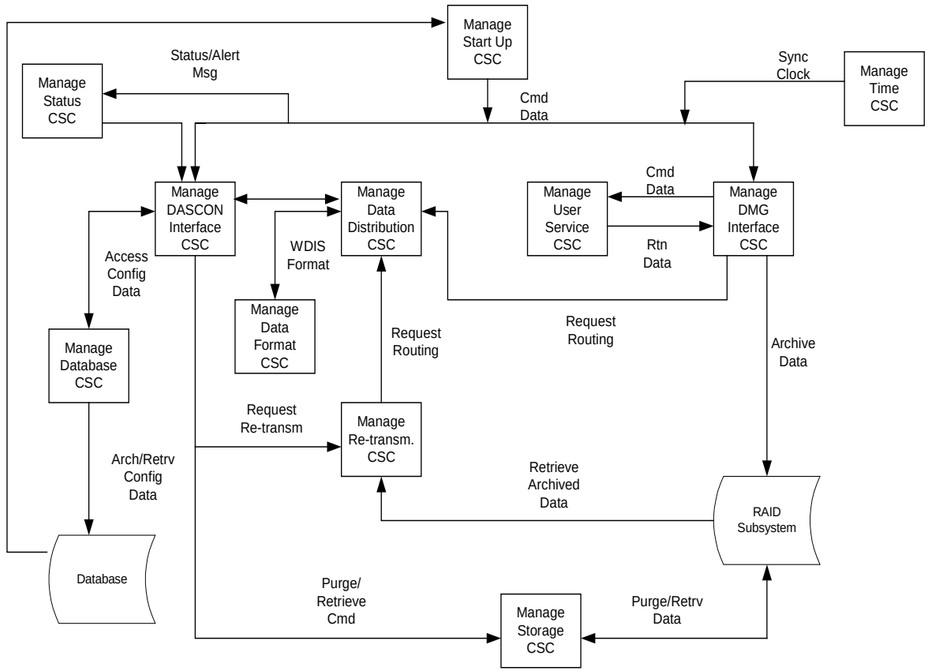
DSER CSCI Design Hierarchy



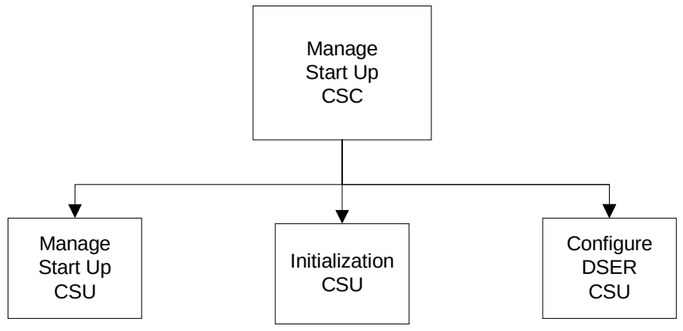
DSER CSCI Design
Processing Flow



DSER CSCI Design
Data Flow

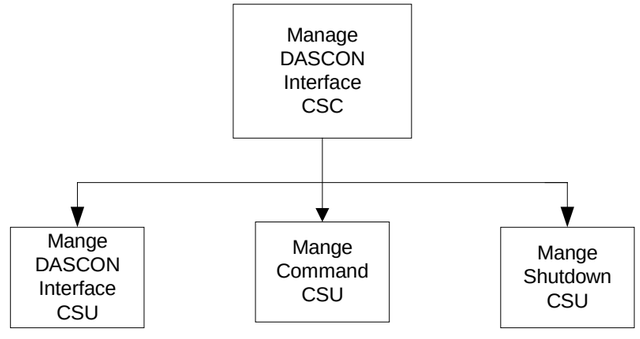


DSER CSCI Design
Manage Start Up CSC



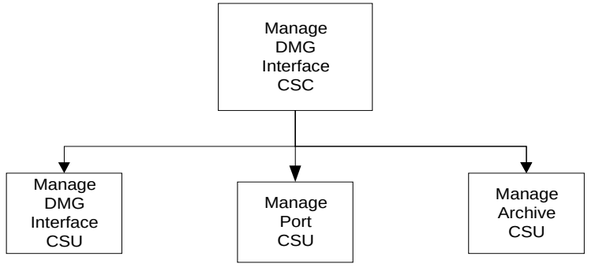
- Initialize all global variables and the database
- Invoke Mange Time CSC once an hour
- Initiates the execution of all interface CSCs

DSER CSCI Design
Manage DASCON Interface CSC



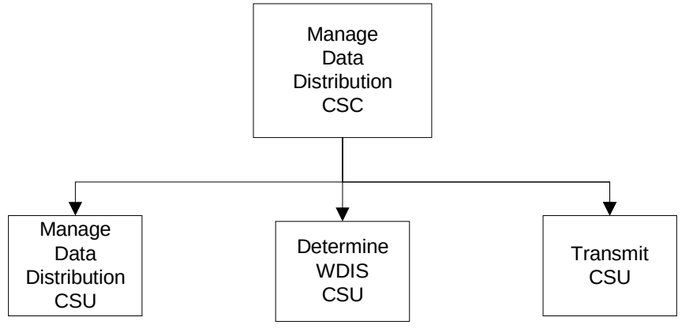
- Handles control and configuration commands from DASCON
- Returns health and status information to DASCON
- Serves as a quasi-controller for DSER

DSER CSCI Design
Manage DMG Interface CSC



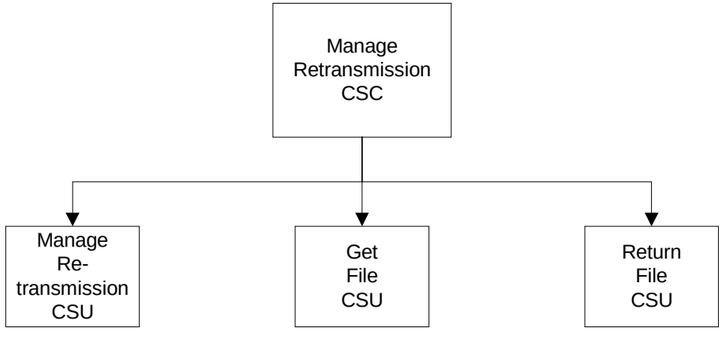
- Manages data throughput of a given DMU to DSER connection
- Monitors port availability
- Archives return data to the RAID sub-system
- Reports DMG/DMU port status to DASCON

DSER CSCI Design
Manage Data Distribution CSC



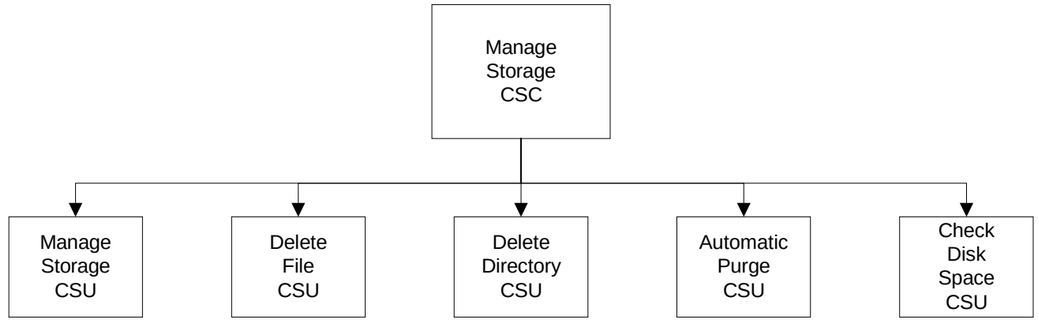
- ❑ Provides port connection for customer return data routing
- ❑ Routes real-time or archived data
- ❑ Determines the data format

DSER CSCI Design
Manage Retransmission CSC



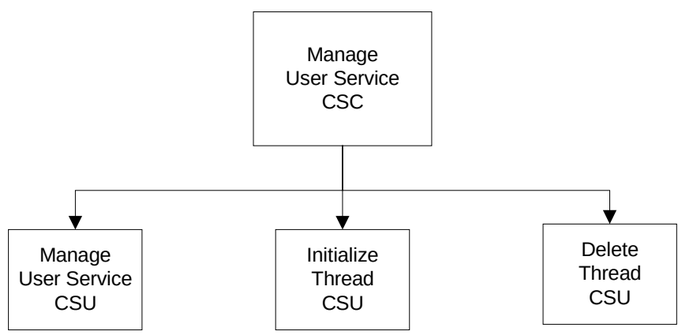
- Retrieves and retransmits archived user data

DSER CSCI Design
Manage Storage CSC



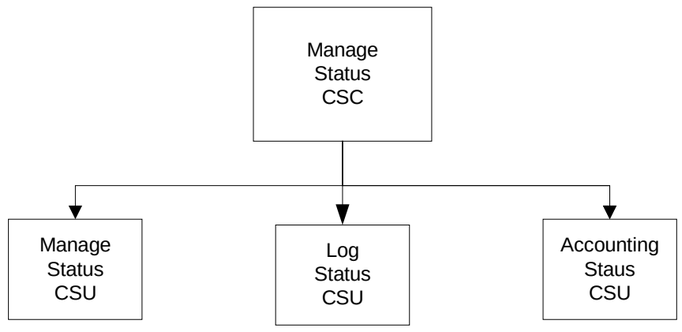
- Alerts DASCON when the RAID subsystem is at 50%, 80%, and 90% capacity
- Automatic data file purge at >= 95% capacity, based on file creation date and FIFO policy

DSER CSCI Design
Manage User Service CSC



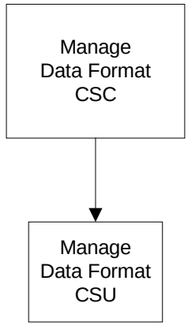
- ❑ **Initialize all threads to support user service (one thread per user)**
- ❑ **Manage thread activities, e.g., monitor number of threads and memory usage by threads.**

DSER CSCI Design
Manage Status CSC



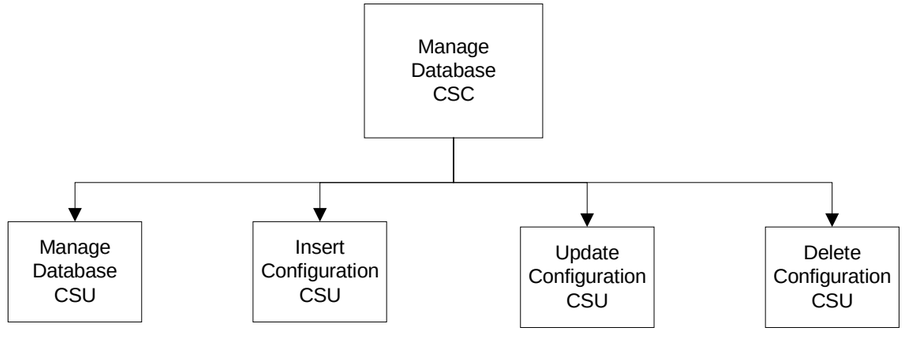
- Reformat received status from other DSER CSCs and send status to DASCON once per second
- Extended status will be kept and forwarded upon request from DASCON.
- Real time alert status will be displayed on the DSER terminal window
- Accounting information will be accumulated

DSER CSCI Design
Manage Data Format CSC



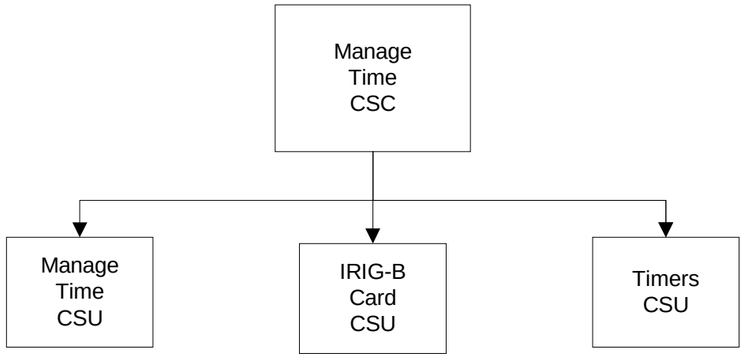
- **Support WDIS return data formats**

DSER CSCI Design
Manage Database CSC



- Maintain the current DSER configuration state
- Synchronize with DASCON's configuration state of DSER by sending a configuration message once per second.

DSER CSCI Design
Manage Time CSC



- Synchronize the system clock with the time kept by the IRIG-B card (ground station time)
- Initiate status report send to DASCON

DMG Controller CI (DCON) Requirements Overview

- **Functional**
  - Control and configure DAS Demodulators (DMUs) and analog IF Switch
  - Provide a Local MMI to the LRU level in support of equipment O&M
  - Support a command and status interface to the DASCON

- **Key Drivers**
  - Report equipment status to DASCON in real-time
  - Formulate and execute equipment configuration commands in real-time on command from DASCON

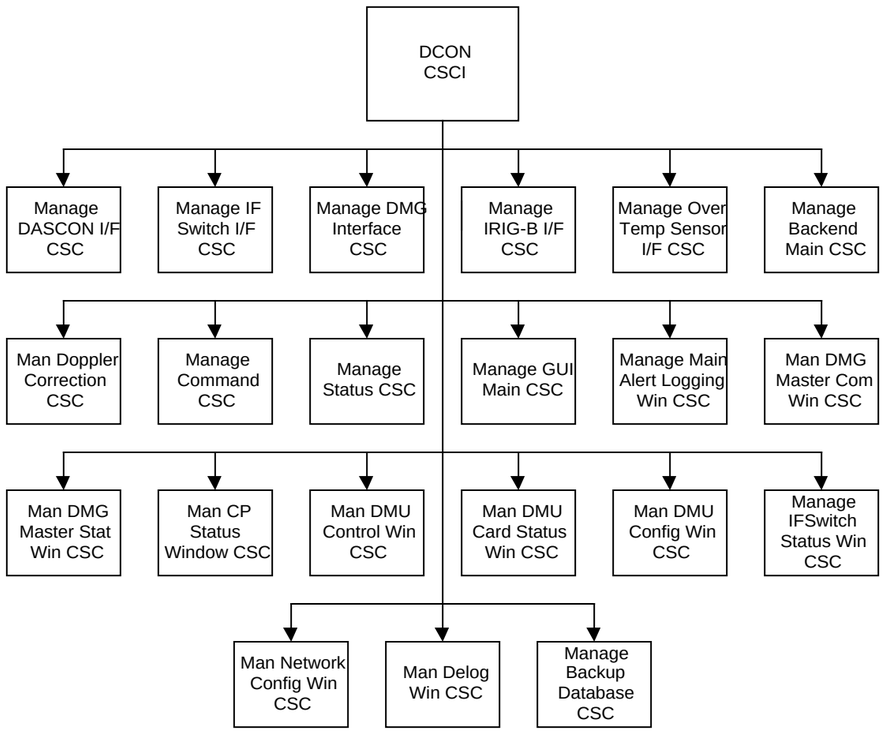
DCON CSCI Design Overview (1 of 2)

- Multi-threaded application which runs under Windows NT 4.0, Terminal Server Edition
- Resides on a Pentium III based, 19” rack mounted PC
- Provides the operator with a graphical user interface to control/configure the DMGs and the IF Switch
- Collects Status from the DMGs and IF Switch via a 10BaseT Ethernet interface using TCP/IP protocol
- Graphically displays the received status and health information on the set of screens
- Utilizes Microsoft Access as a database engine to log status of all DMGs and IF Switch components
- Allows delogging of individual status measurands
- Passes collected status information to the DAS Controller
- Accepts control commands and state vectors from the DAS Controller

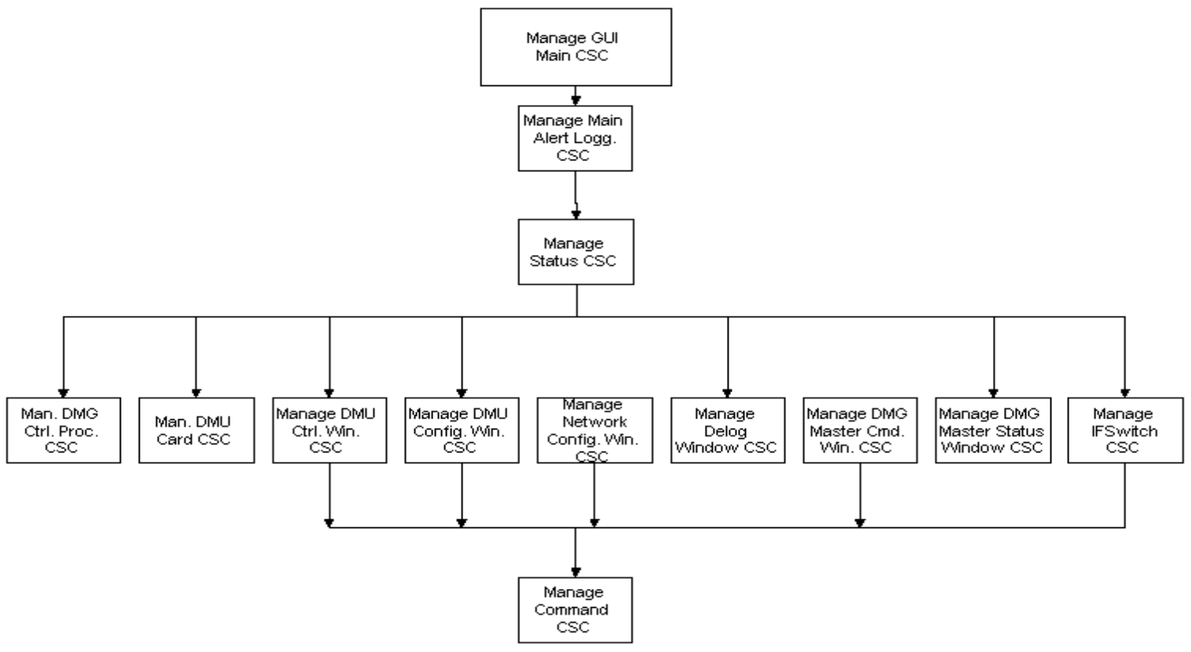
DCON CSCI Design Overview (2 of 2)

- Sends control commands and report requests to the DMGs
- Sends control/configure commands to the IF Switch
- Calculates the Doppler Correction and sends them to the DMGs
- Logs an event alert when an operational abnormality occurs within one second of the occurrence of the abnormality

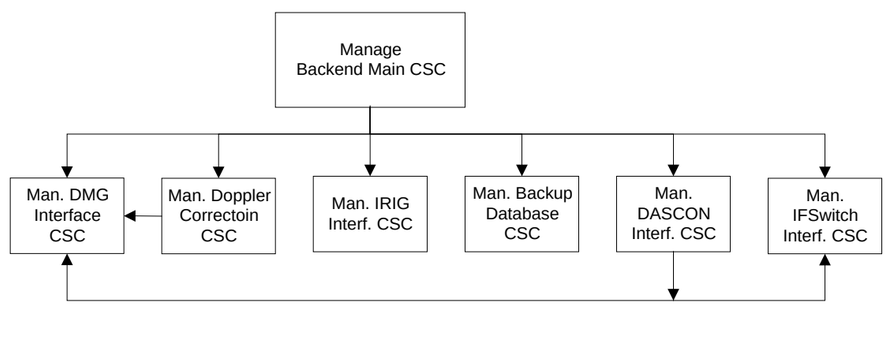
DCON CSCI Design Hierarchy



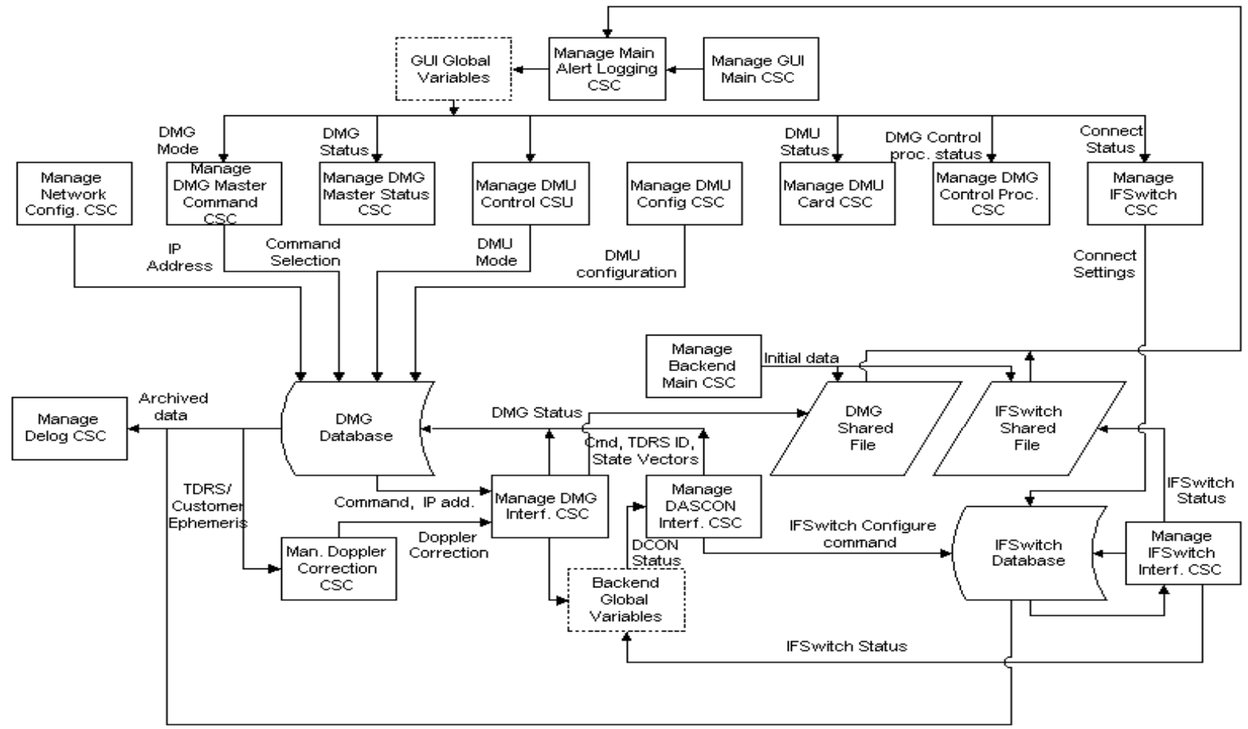
DCON CSCI Design
Processing Flow (GUI)



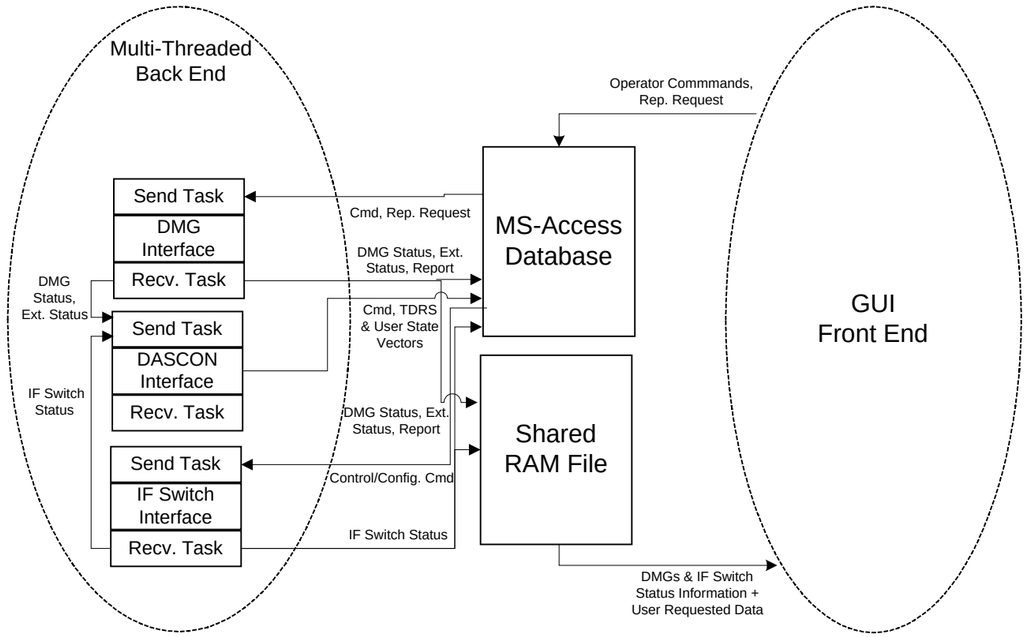
DCON CSCI Design
Processing Flow (Backend)



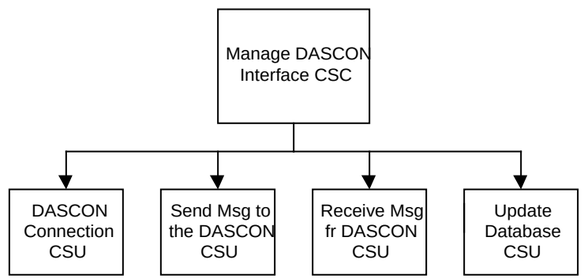
DCON CSCI Design
Data Flow



DCON CSCI Design
Internal Interfaces

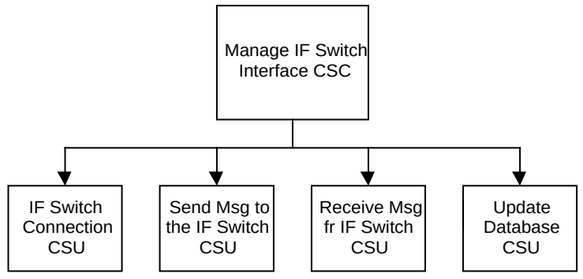


DCON CSCI Design
Manage DASCON Interface CSC



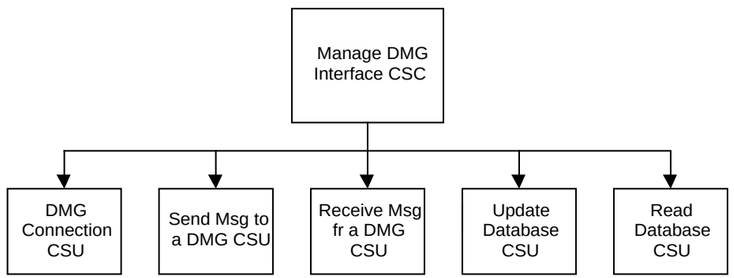
- ❑ Maintains TCP/IP connection with the DASCON
- ❑ Receives commands and TDRS State Vectors from the DASCON
- ❑ Sends DCON and IF Switch Status to the DASCON

DCON CSCI Design
Manage IF Switch Interface CSC



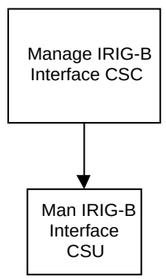
- ❑ **Maintains a serial connection to the IF Switch**
- ❑ **Sends IF Switch configuration commands and request status commands**
- ❑ **Receives IF Switch Status and stores the status to the database**

DCON CSCI Design
Manage DMG Interface CSC



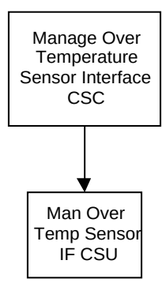
- ❑ **Establishes TCP/IP connections to the DMGs**
- ❑ **Sends commands to the DMGs**
- ❑ **Receives status from the DMGs and stores the status to the database**

DCON CSCI Design
Manage IRIG-B Interface CSC



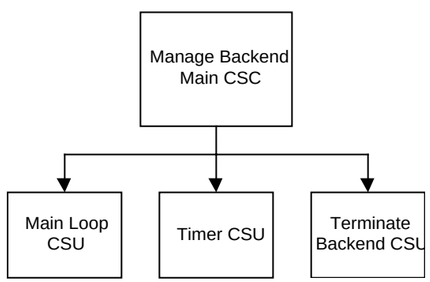
- **Manages the IRIG-B PCI Card to set the DCON Server system clock**

DCON CSCI Design
Manage Over Temperature Interface CSC



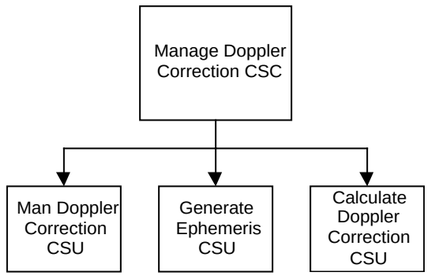
- **Manages the Over Temperature Sensor interface and stores the temperature of the racks to the database**

DCON CSCI Design
Manage Backend Main CSC



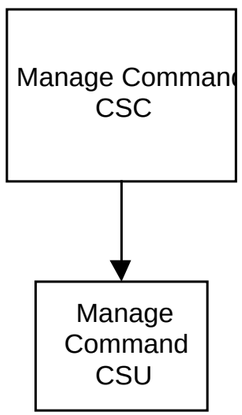
- ❑ Initialize all global variables and open all databases
- ❑ Initiate the execution of all Interface CSCs
- ❑ Invokes the Manage Doppler Correction CSC for each allocated DMU, Manage IRIG-B Interface CSC once an hour (on the half-hour) and the Manage Backup CSC at midnight

DCON CSCI Design
Manage Doppler Correction CSC



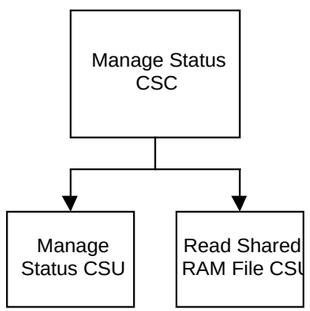
- ❑ **Generates and stores ephemeris for each TDRS**
- ❑ **Propagates each customer's ephemeris in real-time**
- ❑ **Calculates Doppler Correction and invokes the Manage DMG Interface CSC to send the predicted Doppler Frequency and Frequency Rate for 10 seconds in the future every 10 seconds**

DCON CSCI Design
Manage Command CSC



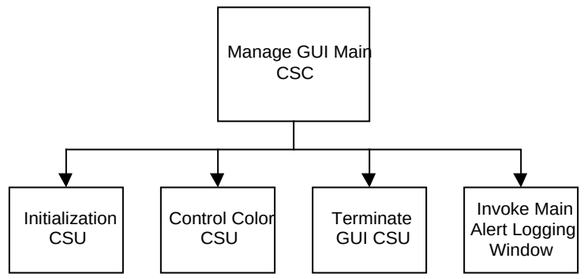
- All GUI Window Commands are sent to this central CSC to be logged and for command initiation

DCON CSCI Design
Manage Status CSC



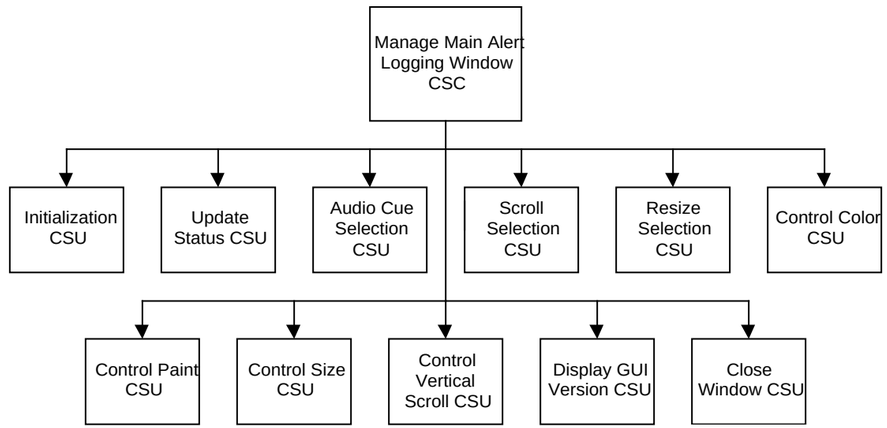
- **Coordinates the updating of the status of all open GUI windows by getting current status data from the shared RAM file**

DCON CSCI Design
Manage GUI Main CSC



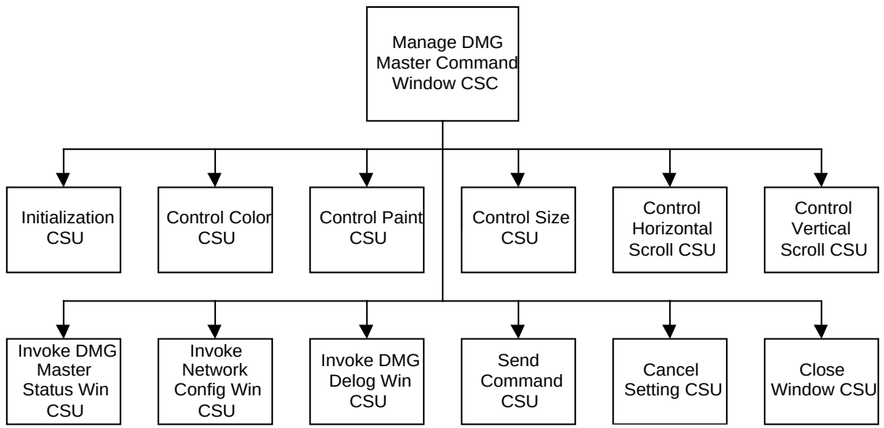
- ❑ Parent of all GUI Windows
- ❑ Can shutdown the GUI by closing this window

DCON CSCI Design
Manage Main Alert Logging Window CSC



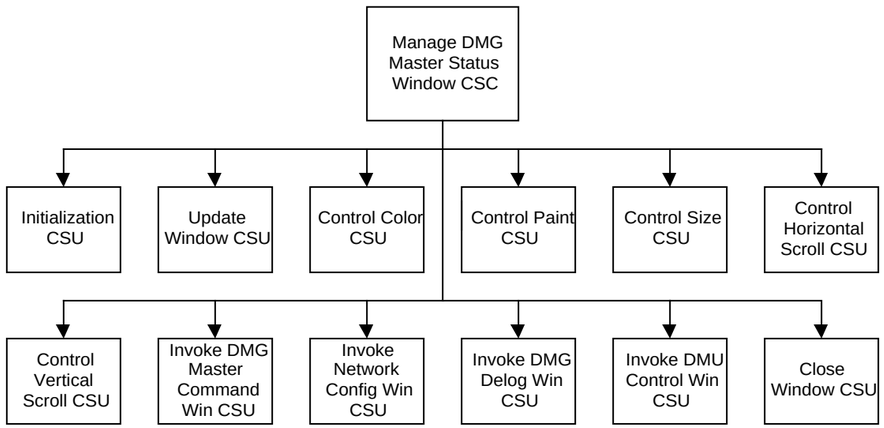
- ❑ **Provides a scrollable, resizeable alert window**
- ❑ **Provides optional audio cue**
- ❑ **Provides high level Demodulator subsystem status**

DCON CSCI Design
Manage DMG Master Command Window CSC



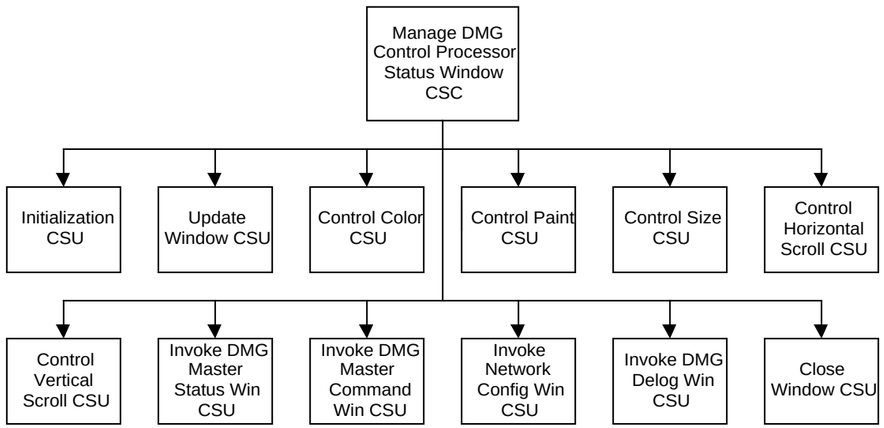
- **View/Change the current mode (online, offline, BIT, not present) for up to eight DMGs**

DCON CSCI Design
Manage DMG Master Status Window CSC



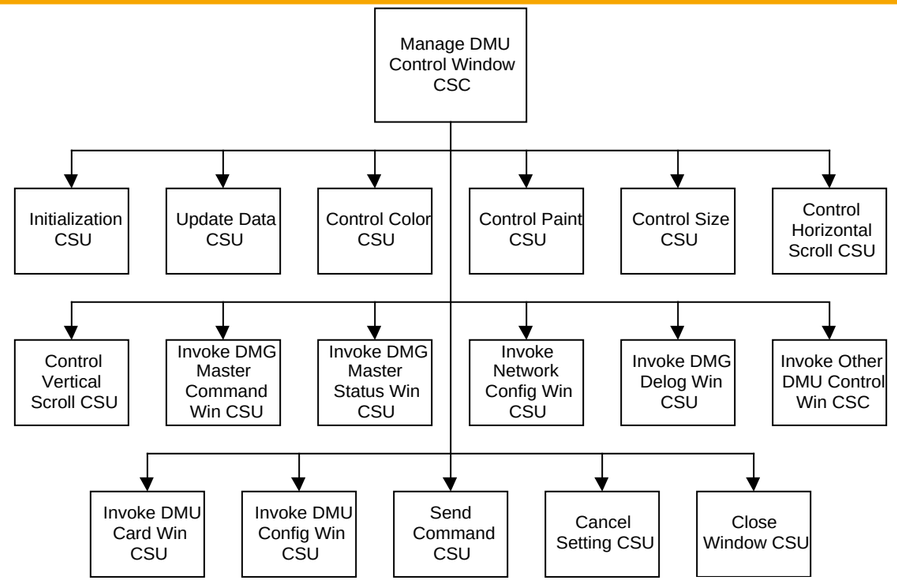
- Shows the status and connectivity for each DMU within a DMG
- Shows the status of the DMG Power Supply and the DMG Interface
- Shows if the DMG is in Remote or Local operation

DCON CSCI Design
Manage DMG CP Status Window CSC



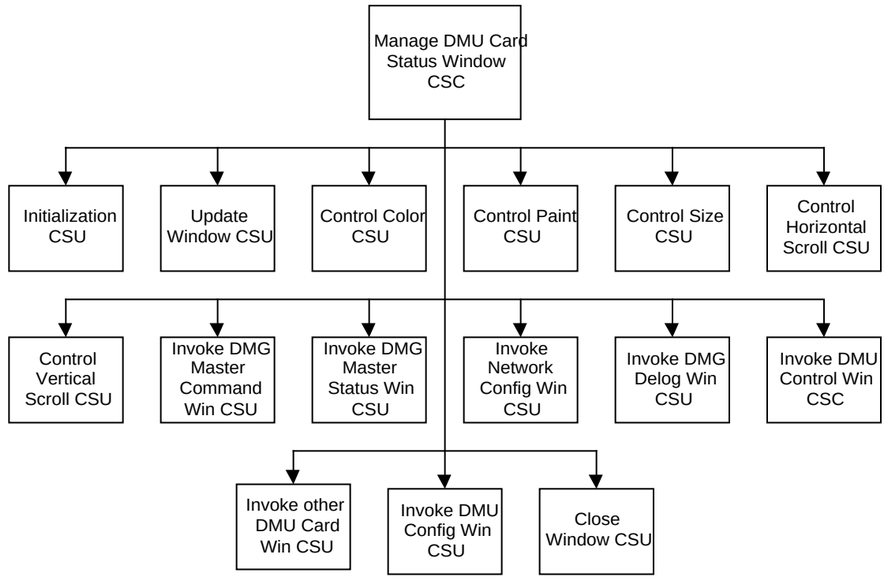
- Shows the DMG Control Processor Faults as Pass/Fail (Operating System, Catastrophic or Software)
- Shows the DMG Control Processor Task Status (OK or Not OK)

DCON CSCI Design
Manage DMU Control Window CSC



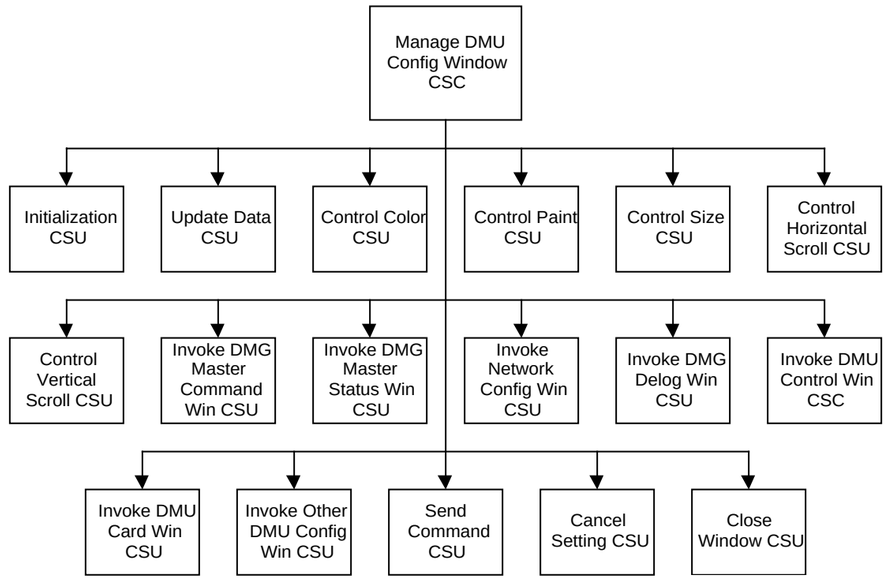
- Can set each DMU to allocated (orbiting/Type 8) or deallocated
- Can input the TDRS State Vector and the Customer State Vector/Latitude and Longitude

DCON CSCI Design
Manage Card Status Window CSC



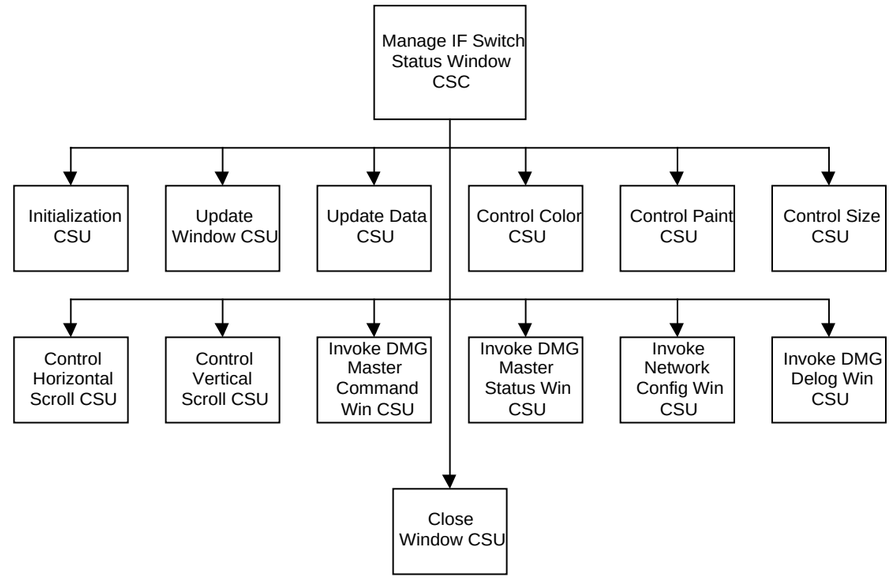
- **Displays a DMUs Performance Data (Acquisition Time, Acquisition Frequency, Loss of Lock Time, Eb/No, etc.)**

DCON CSCI Design
Manage DMU Config Window CSC



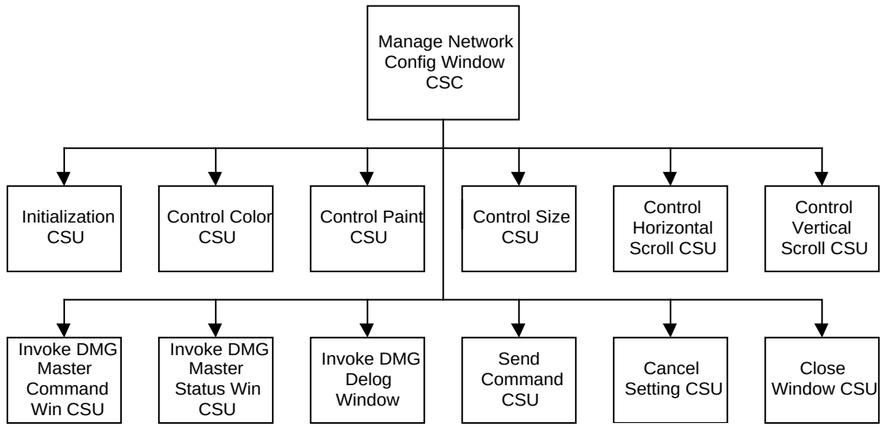
- Can set the configuration of a DMU (data rate, PN Code, Data format, symbol format, etc.)

DCON CSCI Design
Manage IF Switch Status Window CSC



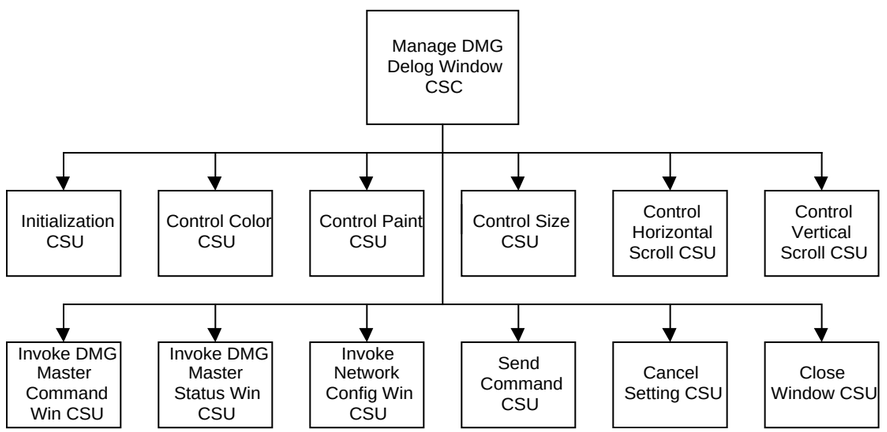
- Displays the port status and port connectivity of the IF Switch

DCON CSCI Design
Manage Network Config Window CSC



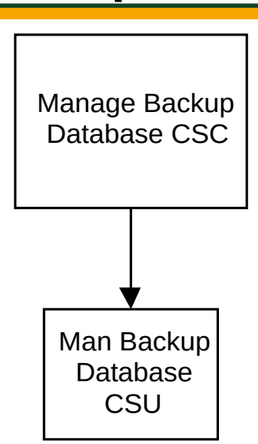
- Can set the IP Address of each DMG when adding a DMG to the DAS (supports modular expandibility)
- Can set the IP address of the DCON's port on the DASCON control network

DCON CSCI Design
Manage DMG Delog Window CSC



- Manages the Delogging of data from the database
- Accepts search keys and search parameters and stores the log file to a specified file

DCON CSCI Design
Manage Backup Database CSC



❑ **Manages the daily backup of the database (up to 45 days)**

IBUG Controller CI (ICON) Requirements Overview

- **Functional**
  - Control and configure DAS IBUGs and EMC Interface CI
  - Provide a Local MMI to support equipment O&M
  - Support a command and status interface to the DASCON
  - Support a GUI enhancement for the EMC Interface CI

- **Key Drivers**
  - None: Virtually identical to the TGBFS ICON with added capability to control the Optical Switch and CDB Switch of the EMC Interface CI.

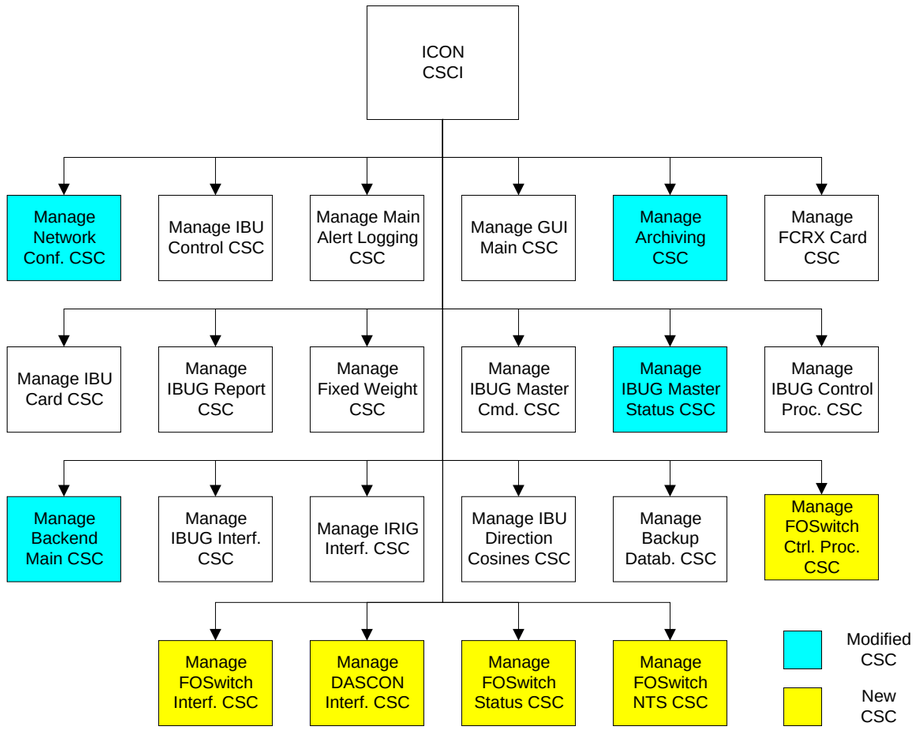
ICON CSCI Design Overview (1 of 2)

- Multi-threaded application which runs under Windows NT 4.0, Terminal Server Edition
- Resides on a Pentium III based, 19” rack mounted PC
- Provides the operator with a graphical user interface to control/configure the IBUGs and the Fiber Optic Switch
- Collects Status from the IBUGs and Fiber Optic Switch via a 10BaseT Ethernet interface using TCP/IP protocol
- Graphically displays the received status and health information on the set of screens
- Utilizes Microsoft Access as database engine to log status of all IBUGs and Fiber Optic Switch compnonets
- Allows delogging of individual status measurands
- Passes collected status information to the DAS Controller via a 10BaseT Ethernet interface using TCP/IP protocol
- Accepts control commands and state vectors from the DAS Controller

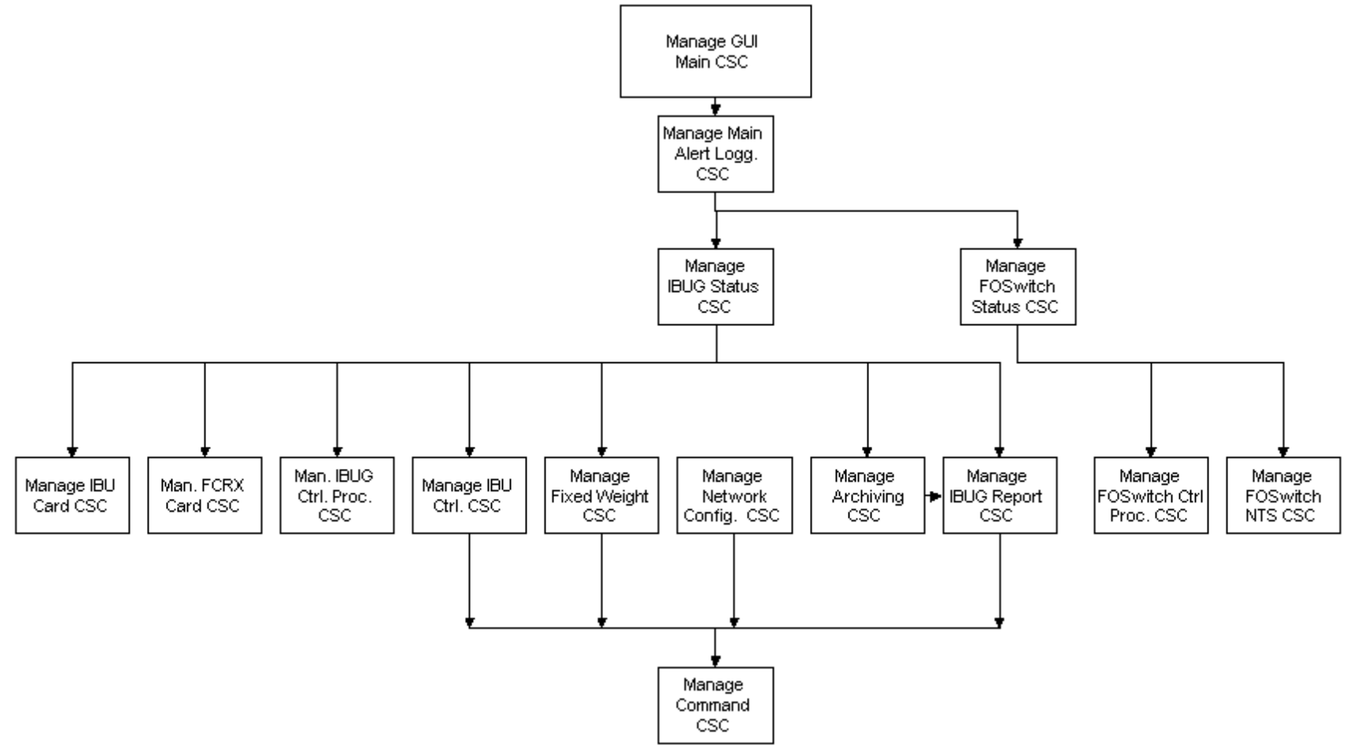
ICON CSCI Design Overview (2 of 2)

- Sends control commands and report requests to the IBUGs
- Sends control/configure commands to the Fiber Optic Switch
- Provides a screen to the operator to accept an IBUG report selection
- Calculates the User Direction Cosines and sends them to the IBUGs
- Displays and Logs an event alert when an operational abnormality occurs within one second of the occurrence of the abnormality

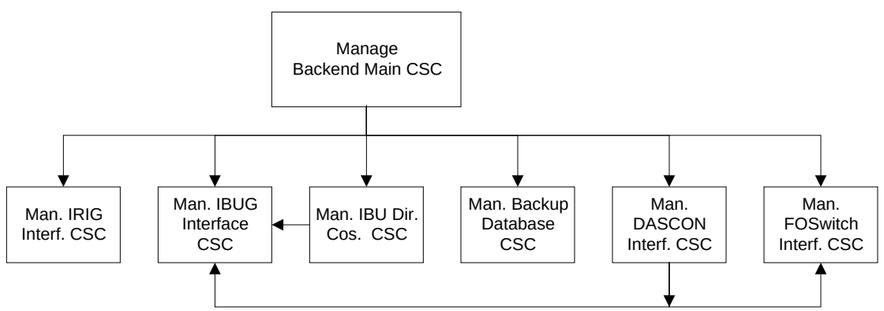
ICON CSCI Design Hierarchy



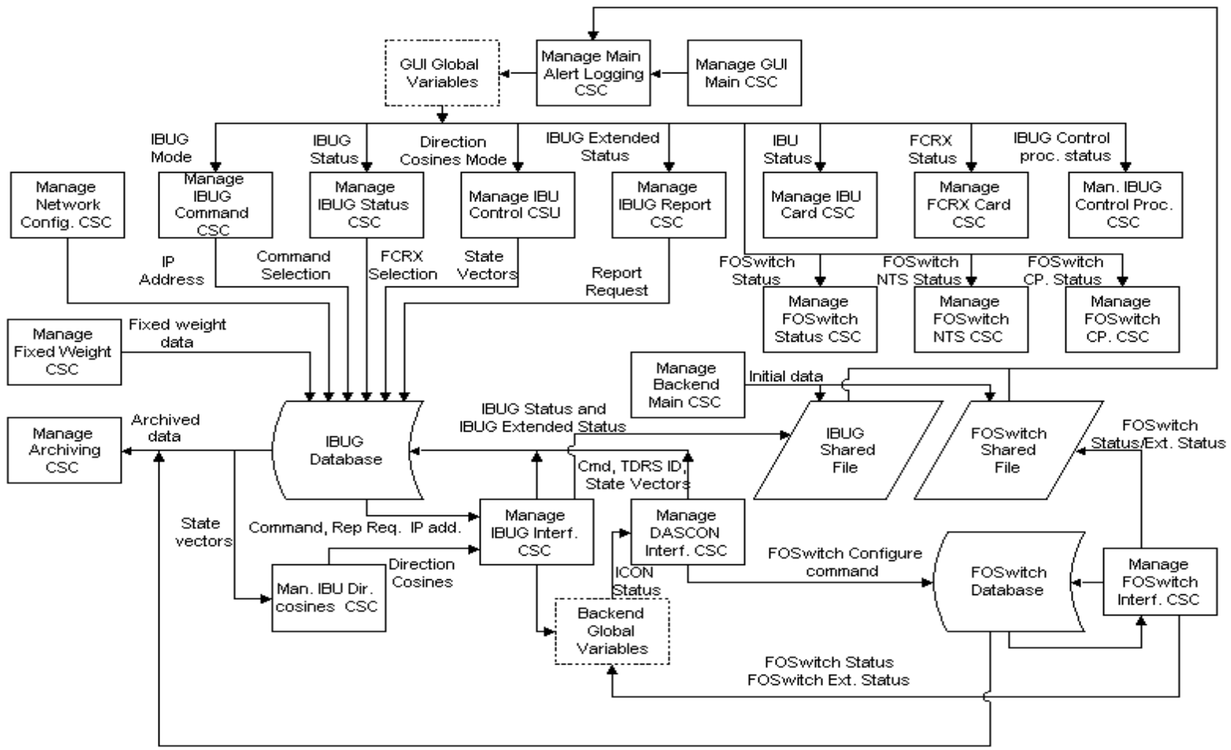
ICON CSCI Design
Processing Flow (GUI)



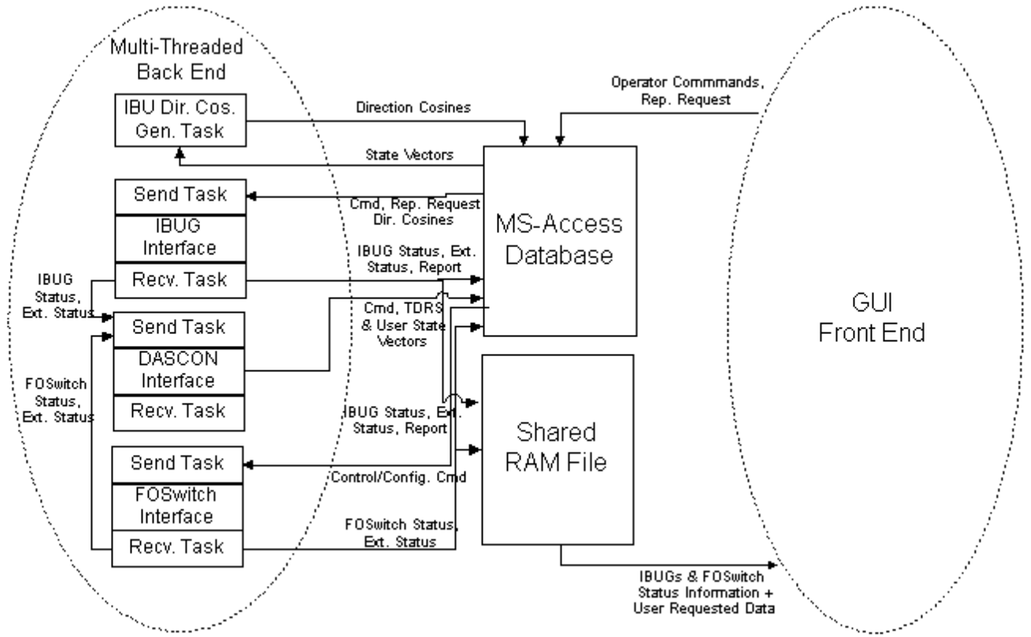
ICON CSCI Design
Processing Flow (Backend)



ICON CSCI Design
Data Flow



ICON CSCI Design
Internal Interfaces



ECON CI
Requirements Overview

- **Functional**
- **(DAS enhancement to existing EMC Controller)**
  - Support a status interface to the DASCON
  - Receive TDRS ID and State Vectors from ADPE Executive and report this information to DASCON
- **Key Performance Drivers**
  - Report State Vectors and EMC/TDRSS status to DASCON in real-time

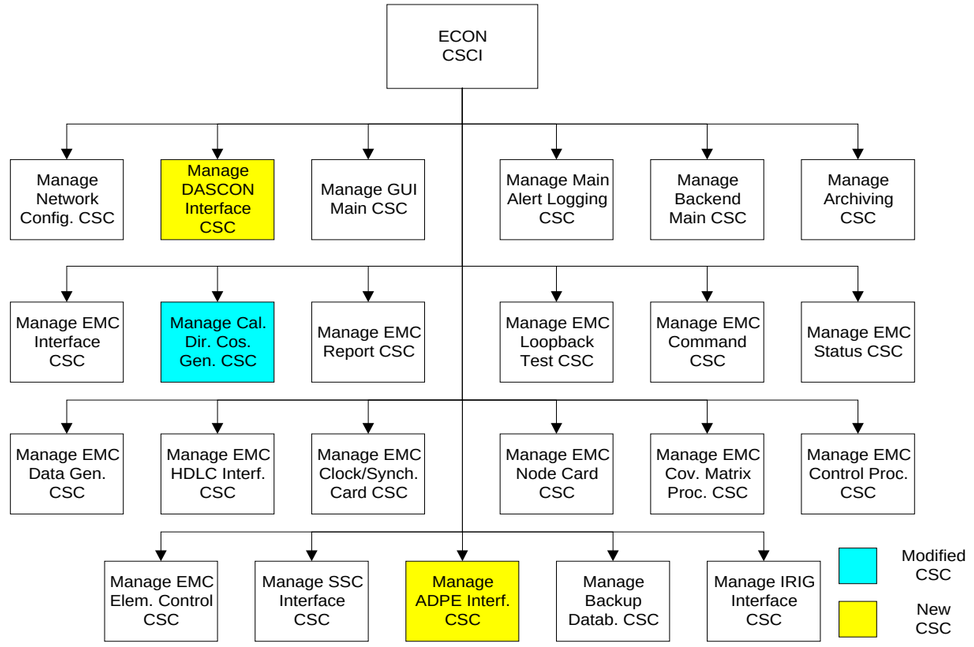
ECON CSCI Design Overview (1 of 2)

- Multi-threaded application runs under Windows NT 4.0, Terminal Server Edition
- Resides on a Pentium II based, 19” rack mounted PC
- Provides operator with a graphical user interface to control/configure the EMC
- Collects Status from the EMC via a 10BaseT Ethernet interface using TCP/IP protocol
- Graphically displays the received status and health information on the set of screens
- Allows delogging of individual status measurands

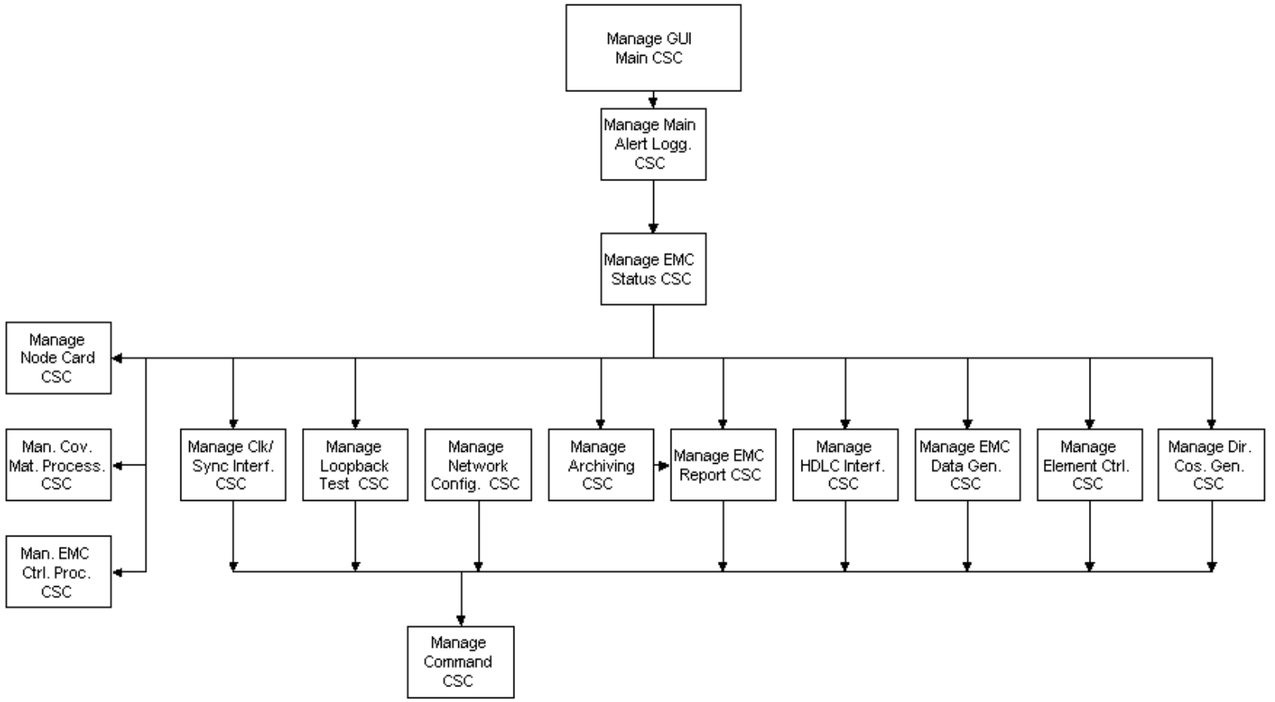
ECON CSCI Design Overview (2 of 2)

- Passes collected status information to the DAS Controller via a 10BaseT Ethernet interface using TCP/IP protocol
- Accepts control commands from the DAS Controller
- Sends control commands and report requests to the EMC
- Receives TDRS state vectors from the ADPE Exec via a RS-232 Serial Interface
- Sends TDRS state vectors to the DAS Controller
- Calculates the User Direction Cosines and sends them to the EMC
- Displays and Logs an event alert when an operational abnormality occurs within one second of the occurrence of the abnormality
- Sends alert message to the MA SSC via a RS-449 serial interface

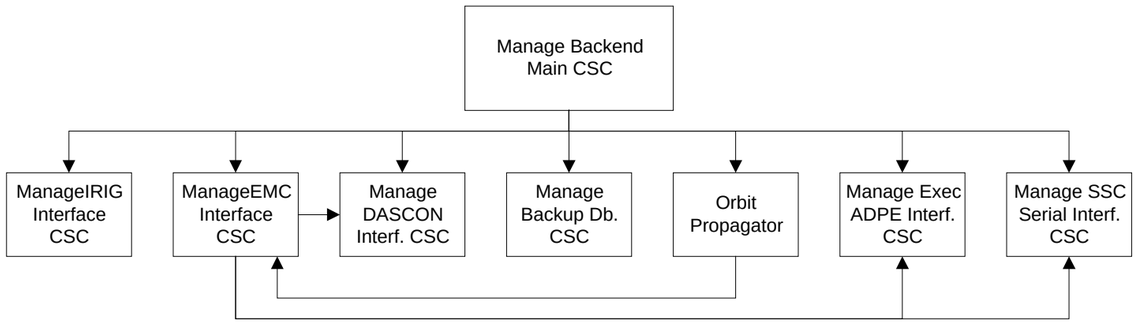
ECON CSCI Design Hierarchy



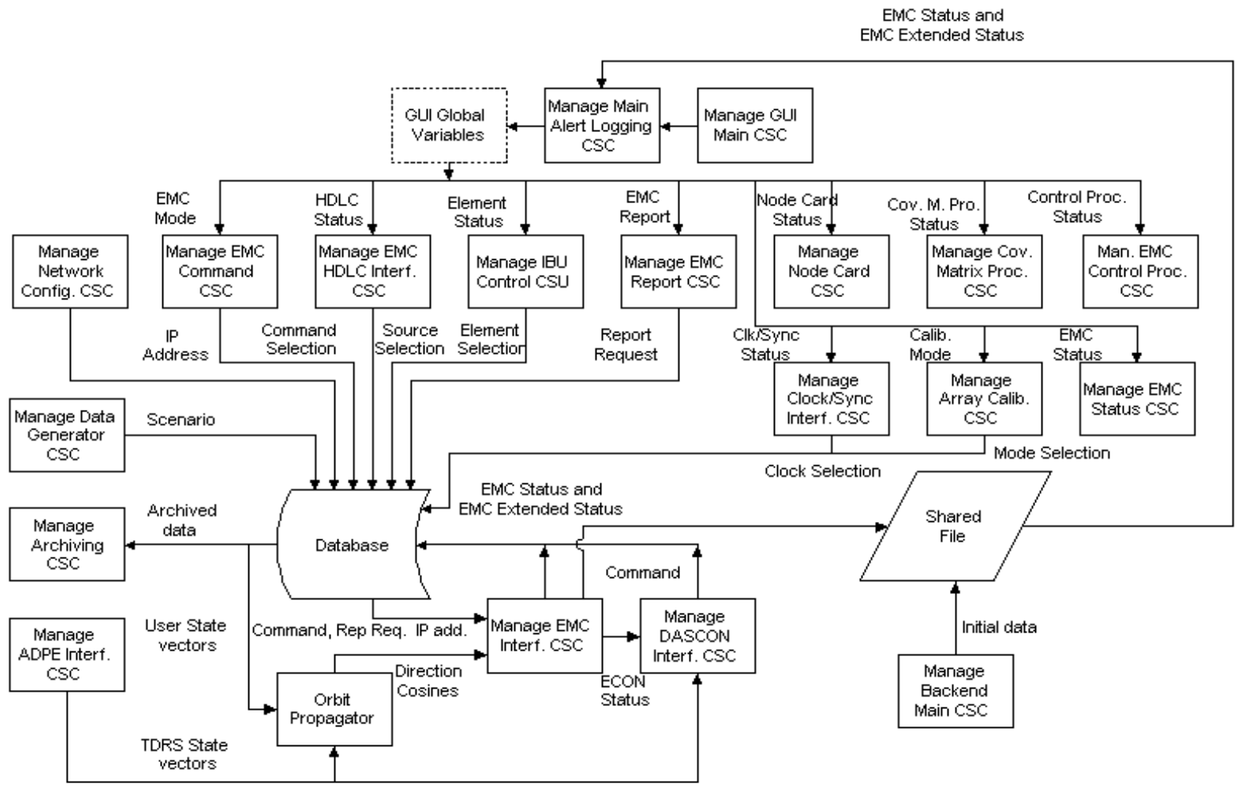
ECON CSCI Design
Processing Flow (GUI)



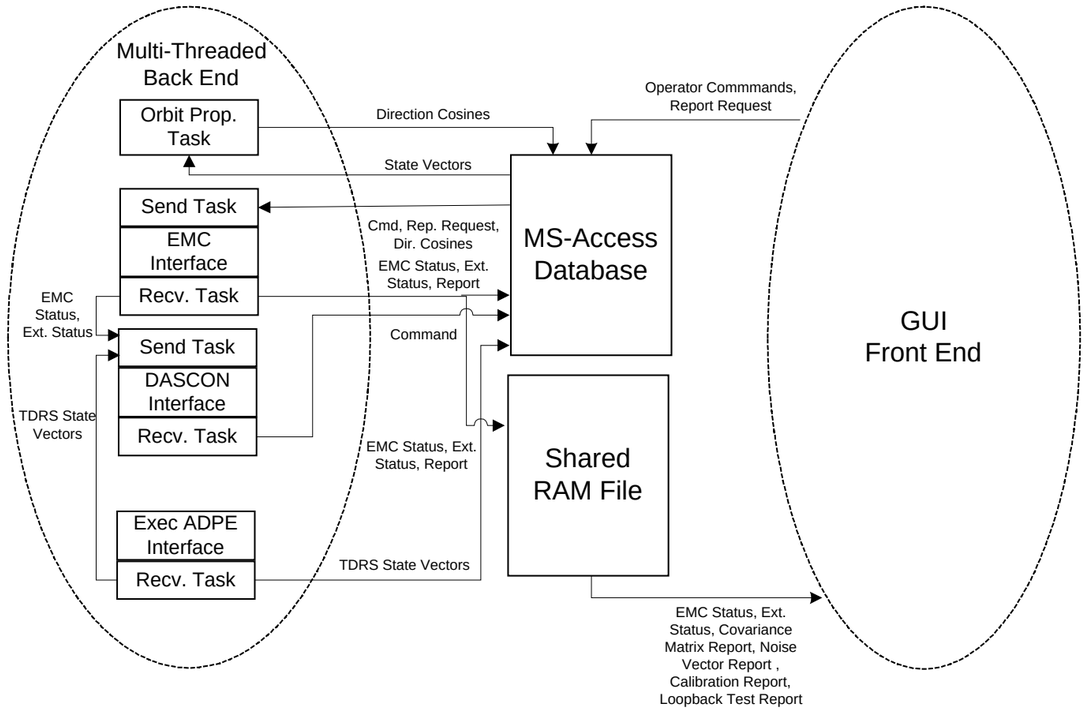
ECON CSCI Design
Processing Flow (Backend)



ECON CSCI Design
Data Flow



ECON CSCI Design
Internal Interfaces



Software Design

BACKUP

Software Requirements Traceability

(See Section 9)

PDR Agenda

- ❑ Program Overview
- ➔ System Overview
- ❑ Requirements Analysis
- ❑ System I&T and Verification
- ❑ Hardware Design
- ❑ Software Design
- ❑ Summary

ITT Summary

- A preliminary design has been presented that appears to meet all DAS requirements;
- Some requirements still to be defined; we have defined paths to definitize them
- The DAS design and implementation are on-schedule
- A Program Plan is in-place that addresses all implementation, verification and deployment requirements
- Critical to minimize further changes to requirements
- ITT requests concurrence to proceed to detailed design (CDR scheduled for 15 February 2001)

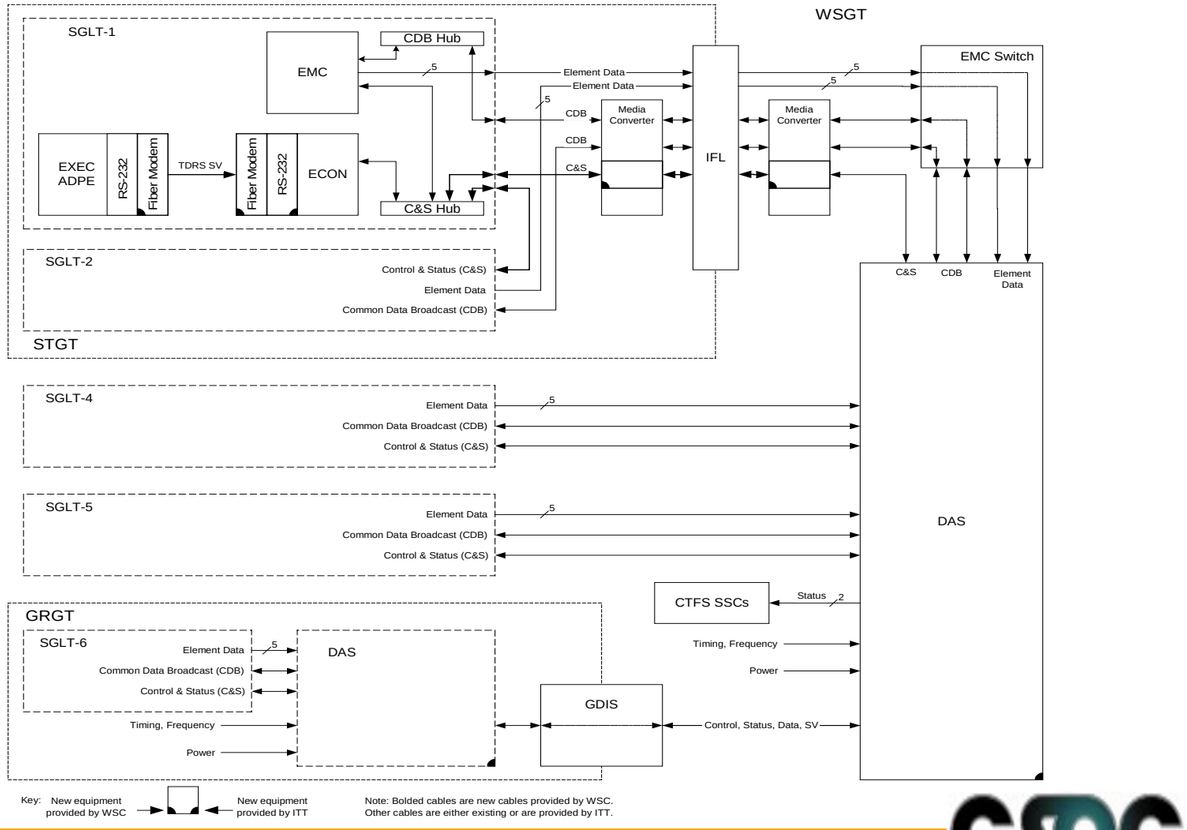
PDR Agenda - Day 2

Software Design I	**10:00 – 12:00**	**Bob Smarrelli**
	LUNCH (60 mins)	
Software Design II	**13:00 – 14:00**	**Bob Smarrelli**
ITT Summary	**14:00 – 14:15**	**Walt Kearns**
	BREAK (15 mins)	
CSOC Review	**14:30 – 15:30**	
	BREAK (15 mins)	
Government Caucus	**15:30 – 16:00**	
RFA Review	**16:00 – 16:30**	

CSOC PDR Agenda

- **Overview of interface design**
- **Overview of Software and Firmware design**
- **Status, Schedule, etc.**

Interfaces - Block Diagram



Interfaces - TDRS State Vector

- TDRS State Vectors are provided by the EXEC ADPE to the ECON in each SGLT.
- Transmitted from the ADPE via an existing RS-232 port and converted to fiber due to the distance between the ADPE and ECON.
- COTS fiber modems used to convert to/from fiber.
- Transferred from the ECON to DAS over the DAS Control and Status network.
- ITT-R will provide the ECON serial interface card, WSC will provide fiber modems and cables between ADPE and ECON.

Interfaces - Alert

- Consists of prime and redundant, serial interfaces between the DAS and the Common Time and Frequency System (CTFS) Subsystem Controllers (SSC).
- SSC sends a status request. DAS responds with a message containing a single status bit. SSC passes status to DIS ADPE where it is reported to the TOCC operator.
- A spare RS-449 port in the CTFS SSC will be used.

Interfaces - SGLT-1, 2 via IFL

- Element Data and Common Data Broadcast will be presented to DAS at the output of the EMC Switch located at WSGT.
- The Media Converters Chassis, IFL path and EMC Switch are being installed under a separate effort.
- The Control and Status (C&S) interface for both SGLTs will be presented at a single ethernet port on a media converter located at WSGT.
- New media converter cards will be installed in existing chassis for C&S interface.

Interfaces - SGLTs 4, 5 and 6

- Common Data Broadcast and Control and Status interfaces will be via ethernet connections at existing hubs in each SGLT.
- Element Data will be transmitted to DAS via multimode fibers connected to existing outputs of the EMCs.

Interfaces - GDIS

- GDIS will act as a line extender between DAS routers at WSGT and GRGT.
- Will provide a single, fixed bandwidth, serial interface to carry multiplexed user data, control and status and SGLT-6 TDRS state vectors between sites.
- Bandwidth is TBD.

Interfaces - CTFS

- **Three signal will be provided to DAS at WSGT and GRGT:**
  - 10 MHz Frequency Reference
    - Prime and redundant signals provided
  - Time of Day Reference
    - Prime and redundant signals provided
  - 1 Pulse Per Second
    - One copy of the signal will be provided
- **Existing spare ports will be used.**

Interfaces - Facilities and I/O Net

- Facility power will be provided at WSC and GRGT. Number, rating and location of circuits is TBD.
- Interface to the I/O Net is TBD.

WSC Software/Firmware Mods
DAS Statusing

- **Firmware changes for statusing:**
  - Enable existing spare status bit in CTFS SSC firmware to provide DAS status to DIS.

- **DIS changes for statusing:**
  - Modify DIS Monitor_Ground_Equipment software/database to process the new status measurand and generate an operator alert if a failed status is received.

WSC Software/Firmware Mods
Ephemeris Download

- **Automatic download of TDRS ephemeris:**
  - Modify the EXC Update_Ephemeris to automatically download TDRS state vectors when new composite ephemeris is received.
  - Download will utilize a dedicated RS232 interface to DAS.

- **Handle operator download requests:**
  - Modify existing vector download tool to provide operator-requested downloads in the event DAS is unreachable when the automatic download occurred.

EC Status

- EC 8266 will be used to document the DAS installation.
- Rack numbers, rack locations and a block of cable numbers have been assigned.
- The majority of the EC effort will take place after CDR.

Schedule/ Issues

- **CSOC is on schedule with assigned tasks.**
- **Issues**
  - Early testing of alert and state vector interfaces is desired but not currently scheduled. ITT has indicated that they should have software ready for testing by the end of the year. Working with WSC software/firmware to determine schedule.

PDR Agenda - Day 2

Software Design I	**10:00 – 12:00**	**Bob Smarrelli**
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Demand Access System (DAS)

Preliminary Design Review

26 - 27 October 2000

SW Requirements Traceability

“DAS – Next Generation Multiple Access Service”

BACKUP

Software Requirements Traceability

Requirements Traceability Matrices
DASCON CSCI

Specific Paragraph	Requirement	Implemented (CSCI-CSC-CSU)	Comment
3.1.1.1.a	The DAS shall accept DAS Customer set(s) of resource configuration parameters.	DASCON - Man Customers CSC	
3.1.1.1.b	The DAS shall accept updates to existing sets of DAS Customer configuration parameters.	DASCON - Man Customers CSC	
3.1.1.1.c	The DAS shall report to DAS Customers the contents of the configuration parameters currently retained.	DASCON - Man Customers CSC, Man Customer Interface CSC	
3.1.1.a	The DAS shall process DAS Customer system access identification information as part of DAS logon procedures.	DASCON - Man Customers CSC	
3.1.2.1.a	The DAS shall collect and log status on each DAS Customer's allocated resources.	DASCON - Man Customers CSC	
3.1.2.1.b	The DAS shall provide periodic, unsolicited summarized resource allocation status reports to each DAS Customer.	DASCON - Man Resources CSC	
3.1.2.1.c	The DAS shall provide periodic, unsolicited summarized resource allocation status reports to the DAS LCM.	DASCON - Man Schedule Maintenance Window CSC	
3.1.2.2.1.a	The DAS shall provide DAS Customers with the option of specifying which TDRS(s) is (are) to be used in the resource allocation service request.	DASCON - Man Customer Interface CSC	
3.1.2.2.1.b	The DAS shall verify the validity of the DAS Customer's requests for TDRS assignments based upon visibility.	DASCON - Man Navigation CSC	

Requirements Traceability Matrices
DASCON CSCI

3.1.2.2.1.c	The DAS shall use ephemeris data to automatically determine the visibility status of a TDRS.	DASCON - Man Navigation CSC	
3.1.2.2.1.d	The DAS shall automatically construct the time windows within a DAS Customer specified time interval in order to identify when a TDRS is visible to a DAS Customer's emitter.	DASCON - Man Navigation CSC	
3.1.2.2.2	The DAS shall provide a report to the DAS Customer, which summarizes the times when planning request constraints can be realized.	DASCON - Man Resources CSC	
3.1.2.2.2.a	The DAS shall automatically assess resource allocation data to determine the allocation status of all DAS resource assets.	DASCON - Man Resources CSC	
3.1.2.2.2.b	The DAS shall automatically identify which DAS resource assets are available for allocation at any given time.	DASCON - Man Resources CSC	
3.1.2.2.2.c	The DAS shall automatically construct the time windows within a DAS Customer specified time interval that identifies when DAS resource assets are available for allocation.	DASCON - Man Resources CSC	
3.1.2.2.2.d	All DAS resources shall be shared to fulfill allocation requests for dedicated and non-dedicated Customers.	DASCON - Man Resources CSC	
3.1.2.2.2.e	The DAS shall automatically assess the availability of resources for non-dedicated Customers use based upon the resources that are available after fulfilling dedicated Customer requests.	DASCON - Man Resources CSC	
3.1.2.2.2.f	The DAS shall combine emitter visibility and resource assets availability information to determine allocations that meet a DAS Customer request.	DASCON - Man Resources CSC	
3.1.2.2.a	The DAS shall accept DAS Customer requests for resource allocation planning information.	DASCON - Man Customer Interface CSC	

Requirements Traceability Matrices
DASCON CSCI

3.1.2.2.b	The DAS shall provide resource allocation availability reports to a DAS Customer for planning such that specific resource allocation information of other Customers is not compromised.	DASCON - Man Resources CSC, Man Customer Interface CSC	
3.1.2.2.c	The DAS shall provide resource availability data to the DAS LCM.	DASCON - Man Schedule Maintenance Window CSC	
3.1.2.3.1.a	The DAS shall accept DAS Customer requests for resource allocations.	DASCON - Man Customer Interface CSC	
3.1.2.3.1.b	The DAS shall automatically allocate resources for the DAS Customers who request resources.	DASCON - Man Resources CSC	
3.1.2.3.1.c	The DAS shall ensure that the allocation of resources for Non-Dedicated Customers is never in conflict with the allocation of resources for Dedicated Customers.	DASCON - Man Resources CSC	
3.1.2.3.1.d	The DAS shall automatically assign resources from the shared pool of DAS resources to non-dedicated Customers when the resources are not required to fulfill dedicated Customers requests.	DASCON - Man Resources CSC	
3.1.2.3.1.e	The DAS shall automatically assign TDRS satellite(s) to a resource allocation request if no specific TDRS satellite(s) is(are) designated in the DAS Customer's request.	DASCON - Man Resources CSC	
3.1.2.3.1.f	The DAS shall log the resource allocation time intervals for each DAS asset.	DASCON - Man Resources CSC	

Requirements Traceability Matrices
DASCON CSCI

3.1.2.3.1.g	The DAS shall automatically make TDRS to TDRS transition assessments that will occur during a service as needed to support the assigning of DAS assets to satisfy each DAS Customer resource allocation request.	DASCON - Man Resources CSC	
3.1.2.3.1.h	The DAS shall provide status to the DAS Customer that reports the action taken as a result of the processing of resource allocation request.	DASCON - Man Resources CSC, Man Customer Interface CSC	
3.1.2.3.1.I	The DAS shall log resource assignment statistics as service accounting data.	DASCON - Man Resources CSC	
3.1.2.3.1.j	The DAS shall support assignment of demodulated signals from multiple emitters in the same beam.	DASCON - Man Resources CSC	
3.1.2.3.1.k	The DAS shall provide resource assignment data to the DAS LCM.	DASCON - Man Schedule Maintenance Window CSC	
3.1.2.3.1.l	The DAS shall notify the DAS Customer of any change to a resource allocation request that prevents the DAS Customer request from being supported.	DASCON - Man Resources CSC	
3.1.2.3.1.m	The DAS shall be capable of removing from the DAS shared resources any resources that are unavailable due to failure or maintenance action.	DASCON - Man Resources CSC	
3.1.2.3.2.a	The DAS shall ensure that a DAS Customer is restricted from modifying requests submitted by other DAS Customers.	DASCON - Manage Customers CSC	

Requirements Traceability Matrices
DASCON CSCI

3.1.2.3.2.b	The DAS shall allow a DAS Customer to modify an accepted request that is pending implementation.	DASCON - Man Resources CSC, Man Customer Interface CSC	
3.1.2.3.2.c	The DAS shall allow a DAS Customer to modify an on-going request.	DASCON - Man Resources CSC, Man Customer Interface CSC	
3.1.2.3.2.d	The DAS shall provide status to the DAS Customer that reports the action taken as the result of the processing of modification requests.	DASCON - Man Resources CSC, Man Customer Interface CSC	
3.1.2.3.2.e	The DAS shall return DAS allocated assets to the pool of unallocated resources if no longer needed to support Customer resource allocation assignments.	DASCON - Man Resources CSC	
3.1.2.3.2.f	The DAS shall log the modification of resource assignments.	DASCON - Man Resources CSC	
3.1.2.4.1.a	The DAS shall automatically accept TDRS vector data in accordance with the WSC Legacy System ICD (TBD).	DASCON - Man ECON Interface CSC	
3.1.2.4.1.c	The DAS shall notify Local Control and Monitor when a TDRS state vector update is overdue.	DASCON - Man Resources CSC	
3.1.2.4.1.d	The DAS shall propagate the last state vector in the existing TDRS ephemeris if a new state vector update is not available.	DASCON - Man Navigation CSC	

Requirements Traceability Matrices
DASCON CSCI

3.1.2.4.1.e	The DAS shall automatically log TDRS ephemeris.	DASCON - Man ECON Interface CSC	
3.1.2.4.2.a	The DAS shall automatically accept DAS Customer emitter vector data.	DASCON - Man Customer Interface CSC	
3.1.2.4.2.b	The DAS shall support manual entry of DAS Customer emitter vector data via the DAS LCM.	DASCON - Man Customer Administration CSC	
3.1.2.4.2.c	The DAS shall automatically access an ephemeris for each DAS Customer emitter during resource allocation assessments.	DASCON - Man Navigation CSC	
3.1.2.4.2.d	The DAS shall automatically log an orbiting DAS Customer emitter ephemeris.	DASCON - Man ECON Interface CSC	
3.1.2.4.2.e	The DAS shall notify a DAS Customer and the DAS LCM when a DAS Customer state vector update is overdue (TBR).	DASCON - Man Resources CSC, Man Main Alert Logging CSC, Man Customer Interface CSC	
3.1.2.4.2.f	The DAS shall propagate the last state vector in the existing DAS Customer ephemeris if a new state vector update is not available.	DASCON - Man Navigation CSC	
3.1.2.4.2.g	The DAS shall retain Type 8 vector data.	DASCON - Man Customers CSC	

Requirements Traceability Matrices
DASCON CSCI

3.1.2.4.2.h	The DAS shall generate an alert to the DAS LCM when TDRS or DAS Customer state vector updates are overdue (TBR).	DASCON - Man Resources CSC, Man Main Alert Logging CSC	
3.1.2.4.3.a	The DAS shall automatically identify outdated ephemerides (TBR).	DASCON - Man Resources CSC	
3.1.2.4.3.b	The DAS shall automatically purge all outdated ephemerides.	DASCON - Man Resources CSC	
3.1.3.1.b	The DAS shall support the Pointing beamforming modes.	DASCON - Man ICON Interface CSC	
3.1.3.1.c	The DAS shall support the Adaptive beamforming mode.	DASCON - Man ICON Interface CSC	
3.1.3.1.d	The DAS shall support the Fixed Weight beamforming mode.	DASCON - Man ICON Interface CSC	
3.1.3.1.f	The DAS beamformer(s) shall switch between EMC output(s).	DASCON - Man ICON Interface CSC	
3.1.5.1.2.c	The DAS shall route real-time Doppler measurement data to DAS Customer specified destination(s).	DASCON - Man Customer Interface CSC	

Requirements Traceability Matrices
DASCON CSCI

3.1.5.1.2.e	The DAS shall route Customer return data delay measurements to DAS Customer specified destination(s)(TBR).	DASCON - Man Customer Interface CSC	
3.1.5.1.2.g	The DAS shall route Customer service performance data to the DAS Customer specified destination(s).	DASCON - Man Customer Interface CSC	
3.1.5.1.3.b	The DAS shall update the service accounting statistics with the return data retrieval statistics.	DASCON - Man DSER Interface CSC	
3.1.5.1.4.c	The DAS shall log the transmit status in the DAS Customer service accounting data.	DASCON - Man Customer Interface CSC	
3.1.5.2.1.c	The DAS shall update the resource usage statistics with the resource information, resource requested and time periods for archiving.	DASCON - Man Resources CSC	
3.1.5.2.1.d	The DAS shall log the storage statistics in the DAS Customer service accounting data.	DASCON - Man DSER Interface CSC	
3.1.5.2.2.a	The DAS shall have a defined maximum allowed storage duration.	DASCON - Man DSER CSC	
3.1.5.2.2.b	The DAS shall automatically remove archived data that has exceeded the limit based on the Customer data distribution specifications.	DASCON - Man DSER CSC	

Requirements Traceability Matrices
DASCON CSCI

3.1.5.2.2.c	The DAS shall automatically remove archived data that has exceeded the pre-set limits defined by configuration management.	DASCON - Man DSER CSC	
3.1.5.2.2.d	The DAS shall log the purge events in the DAS Customer service accounting data.	DASCON - Man DSER CSC	
3.1.6.a	The DAS LCM shall provide an operational interface to monitor, coordinate, control and report the performance of all DAS system components.	DASCON - ALL CSCs	
3.1.6.b	The DAS shall accept system control commands from the DAS LCM.	DASCON - Man Commands CSC	
3.1.6.c	The DAS shall provide system control reports to the DAS LCM.	DASCON - ALL CSCs	
3.1.6.d	The DAS shall accept system status requests from the DAS LCM.	DASCON - ALL CSCs	
3.1.6.e	The DAS shall report system status to the DAS LCM.	DASCON - ALL CSCs	
3.1.6.f	The DAS shall accept DAS Customer authorization parameters from the DAS LCM.	DASCON - Man Customer Administration Window CSC - Update/Add New User	

Requirements Traceability Matrices
DASCON CSCI

3.1.6.g	The DAS shall report the current DAS Customer authorization parameters to the DAS LCM.	DASCON - Man Customer Administration Window CSC - Request User Data	
3.1.6.h	The DAS shall accept requests for service accounting reports from the DAS LCM.	DASCON-DASCON Delog-Service Accounting Report	
3.1.6.i	The DAS shall support enabling and disabling adaptive nulling from the LCM.	DASCON - Man ICON Interface CSC	
3.1.7.1.a	The DAS shall provide status of all components that constitute the DAS to the LCM.	DASCON - ALL CSCs	
3.1.7.1.b	The DAS shall perform periodic and continuous statusing of all components that constitute DAS.	DASCON - All Interface CSCs	
3.1.7.1.c	The DAS shall log all status of all components that constitute DAS.	DASCON - All Interface CSCs	
3.1.7.1.d	The DAS shall support delogging of all collected status.	DASCON - Man Delog Window CSC	
3.1.7.1.e	The DAS shall support printing of delogged status.	DASCON - Man Delog CSC	

Requirements Traceability Matrices
DASCON CSCI

3.1.7.1.f	The DAS shall indicate via an alert to the WSC TOCC when abnormalities are detected in DAS operations and resources.	DASCON - Man Status CSC, Man WSC SSC Alert Interface CSC	
3.1.7.1.g	The DAS shall provide status indicators on the equipment front panels of all components that constitute DAS.	DASCON	
3.1.7.1.h	The DAS shall provide DAS Customer performance status data to the LCM.	DASCON - All CSCs	
3.1.7.1.j	The DAS shall indicate via an alert to the WSC TOCC a detection of an unauthorized entry attempt.	DASCON - Man Customers CSC, Man WSC SSC Alert Interface CSC	
3.1.7.2.a	The DAS shall provide performance status data to the DAS Customer, if requested.	DASCON - Man Customers CSC, Man Customer Interface CSC	
3.1.7.3.a	The DAS shall provide service accounting statistics to the DAS LCM.	DASCON - Man Delog Window CSC -Service Accounting Report	
3.1.7.3.b	The DAS shall allow the definition of a window for the service accounting statistics report to be input from the DAS LCM.	DASCON - Man Customer Admin Window CSC	
3.1.7.3.c	The DAS shall report the duration of approved requests to the DAS LCM for the window specified.	DASCON - Man Schedule Maintenance Window CSC - enter;Update Window	

Requirements Traceability Matrices
DASCON CSCI

3.1.7.3.d	The DAS shall report the duration of actual DAS Customer supported events for the window specified.	DASCON - Man Resources CSC	
3.1.7.3.e	The DAS shall report the cumulative service accounting statistics for each DAS Customer for the window specified.	DASCON - Man Customer Admin Window CSC	
3.1.7.3.f	The DAS shall report the cumulative service accounting statistics for each TDRS for the window specified.	DASCON - Man Schedule Maintenance Win CSC	
3.1.7.3.g	The DAS shall report the cumulative service accounting statistics for all DAS supported events for the window specified.	DASCON - Man Schedule Maintenance Win CSC	
3.1.7.3.h	The DAS shall support printing of the service accounting statistics report.	DASCON - Man Customer Admin Window CSC	
3.1.8.1.a	The DAS shall place itself in a fully operational return data processing state in response to a system startup command.	DASCON - Man Start-Up CSC	
3.1.8.1.b	The DAS shall retain its current operational state resource allocation.	DASCON - Man Resources	
3.1.8.1.c	After a restart operations command has been issued, the DAS shall restore service to its last operational state.	DASCON - Man Start-Up CSC	

Requirements Traceability Matrices
DASCON CSCI

3.1.8.1.d	The DAS shall report incremental status during the start up operations sequence to the DAS LCM.	DASCON - Man Main Screen CSC -Update Window	
3.1.8.1.e	The DAS shall shutdown its operations in an orderly fashion in response to a system operations termination command.	DASCON - Man Main Screen CSC -Update Window	
3.1.8.1.f	The DAS shall report incremental status during the shut down operations sequence to the DAS LCM.	DASCON-Man Main Screen CSC-Update Window	
3.1.8.1.g	The DAS shall detect changes in the DAS internal configuration data to automatically adjust to changes in the system resources during normal operations.	DASCON - All Interface CSCs	
3.1.8.2.a	The DAS shall support adding and removing DAS resources from the pool of shared resources from the DAS LCM.	DASCON - Man Schedule Maintenance Window CSC - Schedule;Remove	
3.1.8.2.b	The DAS shall change the allocation of resources assigned to the shared pool of resources without interrupting normal DAS operations.	DASCON - Man Resources CSC	
3.1.8.3.a	The DAS shall allow only authorized personnel to access DAS Customer authorization data.	DASCON	
3.1.8.3.b	The DAS shall retain Customer authorization data.	DASCON - Man Customers CSC	

Requirements Traceability Matrices
DASCON CSCI

3.1.8.3.c	The DAS shall allow authorized personnel to modify DAS Customer identification parameters without interrupting normal DAS operations.	DASCON - Man Customer Administration Window CSC	
3.1.8.3.d	The DAS shall allow the addition of new DAS Customers without interrupting DAS operations.	DASCON - Man Customer Administration Window CSC	
3.1.8.3.e	The DAS shall allow the deletion of existing DAS Customers without interrupting DAS operations.	DASCON - Man Customer Administration Window CSC	
3.1.8.3.f	The DAS shall report the stored Customer authorization data to authorized personnel only.	DASCON - Man Customer Administration Window CSC	
3.1.9.a	The DAS implementation shall provide for modular expandability of beamformers.	DASCON - Man Resources CSC	
3.1.9.b	The DAS implementation shall provide for modular expandability of demodulators.	DASCON - Man Resources CSC	
3.1.9.e	The DAS implementation shall provide for modular expandability for processing function.	DASCON - Man Resources CSC	
3.2.1.1.a	The DAS shall permit each DAS Customer to simultaneously maintain up to 10 (TBR) resource allocation configuration data sets.	DASCON - Man Customers CSC	

Requirements Traceability Matrices
DASCON CSCI

3.2.1.a	The DAS shall report the results of a DAS Customer authorization check within 10 (TBR) seconds of the receipt of the logon request.	Moved to SWSI	
3.2.2.1.a	The DAS shall automatically log resource allocation status at 1 (TBR) minute intervals.	DASCON - Man Resources CSC	
3.2.2.1.b	The DAS shall automatically report resource allocation status at 1 (TBR) minute intervals.	DASCON - Man Resources CSC	
3.2.2.2.1.a	The DAS shall assess visibility time windows at least 72 hours into the future for the time interval contained within a resource allocation request for a non-dedicated Customer.	DASCON - Man Resources CSC	
3.2.2.2.1.b	The DAS shall assess visibility time windows at least 24 hours greater than the windows computed in 3.2.2.2.1.a for the time interval contained within a resource allocation request for a dedicated Customer.	DASCON - Man Resources CSC	
3.2.2.2.2.a	The DAS shall assess resource allocation availability over intervals that are no larger than 48(TBR) hours from the time of a resource allocation request.	DASCON - Man Resources CSC	
3.2.2.3.1.a	The DAS shall execute TDRS to TDRS transitions when the angle from zenith of the upcoming TDRS is equal to or smaller than the angle from zenith of the current TDRS as viewed from the DAS Customer satellite's center of mass.(TBR).	DASCON - Man Resources CSC	
3.2.2.3.1.b	The DAS shall execute TDRS to TDRS transitions with no more than 15 (TBR) seconds of service outage.	DASCON - Man Resources CSC	

Requirements Traceability Matrices
DASCON CSCI

3.2.2.3.1.c	The DAS shall provide status updates to the DAS Customers within 1 (TBR) minute of a resource allocation change after commencement of service.	DASCON - Man Resources CSC, Man Customer Interface CSC	
3.2.2.3.1.d	The DAS shall reject resource allocation requests that are to be implemented within less than 2 (TBR) minutes after the receipt of the request.	DASCON - Man Resources	
3.2.2.3.1.e	The DAS shall notify the DAS Customer when the resource request is approved what TDRS(s) will support the request, including any TDRS to TDRS transitions.	DASCON - Man Resources CSC, Man Customer Interface CSC	
3.2.2.3.1.f	The DAS shall notify the DAS Customer at the service start time (TBR) of the inability to support an accepted request.	DASCON - Man Resources CSC, Man Customer Interface CSC	
3.2.2.3.2.a	The DAS shall implement allocation modification requests within 30 seconds (TBR) of receipt of the request.	DASCON - Man Resources CSC	
3.2.2.3.2.b	The DAS shall reject resource allocation modifications within 1 (TBR) minute prior to the time that the service is terminated.	DASCON - Man Resources CSC	
3.2.2.4.1.a	The DAS shall maintain no more than 48 hours (TBR) of propagated TDRS ephemerides.	DASCON - Man Navigation CSC	
3.2.2.4.2.a	The DAS shall notify a DAS Customer 2 hours (TBR) prior to the time that an ephemeris update is due if a state vector update has not been received.	DASCON - Man Resources CSC	

Requirements Traceability Matrices
DASCON CSCI

3.2.2.4.2.b	The DAS shall maintain no more than 48 hours (TBR) of propagated DAS Customer ephemerides.	DASCON - Man Navigation CSC	
3.2.2.4.2.c	DAS shall ensure that propagated ephemeris is available 2 (TBR) minutes prior to the start of the DAS Customer requested support.	DASCON - Man Resources CSC	
3.2.2.4.2.d	DAS shall maintain Type 8 vector data indefinitely.	DASCON - Man Customers CSC	
3.2.5.1.3.a	The DAS shall respond to the retrieve archived return data request within 30 seconds (TBR).	DASCON - Man DSER CSC	
3.2.5.1.3.b	The DAS shall retrieve and transmit archived data within 1 minute (TBR) of the specified time.	DASCON - Man DSER CSC, Man DSER Interface CSC	
3.2.5.1.3.c	The DAS shall reject archived data retrieval requests received within 1 minute (TBR) of the request start time.	DASCON - Man DSER CSC	
3.2.5.2.1.b	The DAS shall simultaneously manage archiving up to 50 (TBR) return data streams.	DASCON - Man DSER CSC	
3.2.5.2.1.d	Notification shall be provided to the DAS LCM when the archived storage device is 90 percent (TBR) full.	DASCON - Man Main Screen CSC-Update Window	

Requirements Traceability Matrices
DASCON CSCI

3.2.6.a	The DAS shall automatically provide status reports of all components that constitute DAS to the Local Control Monitor with a 5 second refresh rate.	DASCON - ALL CSCs	
3.2.7.1.a	DAS shall log status of all components that constitute DAS every 1 second. (TBR)	DASCON - All Interface CSCs	
3.2.7.1.b	DAS shall time stamp all delogged status outputs.	DASCON - Man Delog Window CSC -Send Command	
3.2.7.1.c	DAS shall allow delogging of status based on data value changes only.	DASCON - Man Delog Window CSC -Send Command	
3.2.7.1.d	DAS shall log an event alert when an operational abnormality occurs within 1 second (TBR) of the occurrence of the abnormality.	DASCON - All Interface CSCs	
3.2.7.1.e	The DAS shall provide status of all components that constitute DAS on demand.	DASCON - Man Status CSC	
3.2.7.1.f	The DAS shall provide DAS Customer performance status data to the LCM on demand.	DASCON - All CSCs	
3.2.7.1.g	The DAS shall allow delogging of individual status measurands.	DASCON - Man Delog Window CSC-Send Command	

Requirements Traceability Matrices
DASCON CSCI

3.2.7.1.h	The DAS shall maintain system status log data for at least 45 days. (TBR)	DASCON - Man Delog CSC-Send Command	
3.2.7.2.a	The DAS shall provide performance status data to the DAS Customer at 1 minute intervals at the commencement of service.	DASCON - Man DCON Interface CSC, Man Customer Interface CSC	
3.2.7.3.a	The service accounting statistics report shall be available at the LCM within 1 minute (TBR) of the submitted request.	DASCON - Man Customer Interface CSC	
3.3.3.a	The DAS shall exchange information with DAS Customers in accordance with the specifications in the DAS to Customer ICD. (TBD)	DASCON - Man Customer Interface CSC	
3.3.4.a	The DAS shall interface with the WSC Legacy Systems in accordance with the specifications found in the DAS to WSC Legacy System ICD. (TBD)	DASCON - Man ECON Interface CSC, Man WSC SSC Alert Interface CSC	

Requirements Traceability Matrices
DSER CSCI

Specific Paragraph	Requirement	Implemented (CSCI-CSC-CSU)	Comments
3.1.5.1.1.a	The DAS shall route serial, bit-stream contiguous return data.	DSER-Manage Data Distribution CSC	
3.1.5.1.1.b	The DAS shall route CCSDS compatible return data.	DSER-Manage Data Distribution CSC	
3.1.5.1.2.a	The DAS shall route Customer data to specified destination(s) in accordance with the DAS to Customer ICD (TBD).	DSER-Manage Data Distribution CSC	
3.1.5.1.2.b	The DAS shall route real-time MA return telemetry data to DAS Customer specified destination(s)..	DSER-Manage Data Distribution CSC	
3.1.5.1.2.d	The DAS shall route retrieved archived MA return telemetry data to DAS Customer specified destination(s).	DSER-Manage Data Distribution CSC, Manage Retransmission CSC	
3.1.5.1.3.a	The DAS shall retrieve archived return data based on DAS Customer request.	DSER-Manage Retransmission CSC	
3.1.5.1.3.b	The DAS shall update the service accounting statistics with the return data retrieval statistics.	DSER-Manage STATUS	
3.1.5.1.4.a	The DAS shall establish connection(s) with destination(s) to send return data.	DSER-Manage Data Distribution CSC	
3.1.5.1.4.b	The DAS shall automatically re-establish a connection when the connection to a destination is severed.	DSER-Manage Data Distribution CSC	
3.1.5.1.4.c	The DAS shall log the transmit status in the DAS Customer service accounting data.	DSER-MANAGE Status CSC	
3.1.5.1.4.d	The DAS shall route real-time and archived return data to a DAS Customer simultaneously, if requested.	DSER-Manage Data Distribution CSC, Manage Retransmission CSC	
3.1.5.1.4.e	The DAS shall manage the utilization of the GRGT-to-WSGT allowable aggregate bandwidth to support real-time and archived retrieval supports. (TBR).	DASCON	
3.1.5.1.4.f	The DAS shall manage the utilization of the WSC allowable aggregate bandwidth to support real-time and archived retrieval supports. (TBR)	DASCON	
3.1.5.2.1.a	The DAS shall archive all real-time return data.	DSER-Manage DMG Interface CSC	
3.1.5.2.1.b	The DAS shall maintain DAS Customer data for the retention duration requested by the DAS Customer as automated archive management parameters.	DSER-Manage Storage CSC	
3.1.5.2.1.c	The DAS shall update the resource usage statistics with the resource information, resource requested and time periods for archiving.	DSER-Manage Status CSC	
3.1.5.2.1.d	The DAS shall log the storage statistics in the DAS Customer service accounting data.	DSER-Manage Status CSC	

Requirements Traceability Matrices
DSER CSCI

3.1.5.2.2.b	The DAS shall automatically remove archived data that has exceeded the limit based on the Customer data distribution specifications.	DSER-Manage Storage CSC	
3.1.5.2.2.c	The DAS shall automatically remove archived data that has exceeded the pre-set limits defined by configuration management.	DSER-Manage Storage CSC	
3.1.7.1.g	The DAS shall provide status indicators on the equipment front panels of all components that constitute DAS.	DASCON	
3.1.8.1.a	The DAS shall place itself in a fully operational return data processing state in response to a system startup command.	DSER-Manage Start Up CSC	
3.1.8.1.e	The DAS shall shutdown its operations in an orderly fashion in response to a system operations termination command.	DSER Manage DASCON Interface CSC	
3.1.8.1.f	The DAS shall report incremental status during the shut down operations sequence to the DAS LCM.	DSER-Manage Status CSC	
3.1.9.c	The DAS implementation shall provide for modular expandability for archiving Customer data.	DSER-Manage DMG Interface CSC	
3.1.9.d	The DAS implementation shall provide for modular expandability for routing Customer data.	DSER-Manage Data Distribution CSC	
3.1.9.e	The DAS implementation shall provide for modular expandability for processing function.	DSER-Manage DASCON Interface CSC	
3.2.5.1.1.1.a	The DAS shall support Internet Protocol (IP) for routing data to Customers.	DSER-Manage Data Distribution CSC	
3.2.5.1.1.1.b	The DAS shall support frame sync based CCSDS protocol for routing data to Customers.	DSER-Manage Data Distribution CSC	
3.2.5.1.1.1.c	The DAS shall support routing serial, bit-stream contiguous data to Customers.	DSER-Manage Data Distribution CSC	
3.2.5.1.3.a	The DAS shall respond to the retrieve archived return data request within 30 seconds (TBR).	DSER-Manage Retransmission CSC	
3.2.5.1.3.b	The DAS shall retrieve and transmit archived data within 1 minute (TBR) of the specified time.	DSER-Manage Retransmission CSC, Manage Data Distribution CSC	
3.2.5.1.4.a	The DAS shall transmit return data to a maximum of 50 (TBR) DAS Customers simultaneously.	DSER-Mange Data Distribution CSC	
3.2.5.1.a	The DAS shall provide a data delay time stamp with an accuracy of 5 microsecs or less (TBR).	DSER-Manage Time CSC	
3.2.5.2.1.a	The DAS shall provide no less than 100 Mbytes (TBR) of storage space to archive return data.	DSER-Manage DMG Interface CSC	
3.2.5.2.1.b	The DAS shall simultaneously manage archiving up to 50 (TBR) return data streams.	DSER-Manage DMG Interface CSC	
3.2.5.2.1.c	Archived data shall be overwritten on a first in, first out basis.	DSER-Manage DMG Interface CSC	
3.2.5.2.1.d	Notification shall be provided to the DAS LCM when the archived storage device is 90 percent (TBR) full.	DSER-Manage Storage CSC	

Requirements Traceability Matrices
DCON CSCI

Specific Paragraph	Requirement	Implemented (CSCI-CSC-CSU)	Comment
3.1.2.4.2.f	The DAS shall propagate the last state vector in the existing DAS Customer ephemeris if a new state	DCON-Man Doppler Correction CSC	
3.1.2.4.2.1.a	The DAS shall provide Doppler correction for customer emitters	DCON-Man Doppler Correction CSC	
3.1.6.a	The DAS LCM shall provide an operational interface to monitor, coordinate, control and report the	DCON-Man GUI Main CSC	
3.1.6.b	The DAS shall accept system control commands from the DAS LCM.	DCON-Man Status CSC	
3.1.6.c	The DAS shall provide system control reports to the DAS LCM.	DCON-Man GUI Main CSC	
3.1.6.d	The DAS shall accept system status requests from the DAS LCM.	DCON-Man GUI Main CSC	
3.1.6.e	The DAS shall report system status to the DAS LCM.	DCON-Man GUI Main CSC	
3.1.7.1.a	The DAS shall provide status of all components that constitute the DAS to the LCM.	DCON-Man GUI Main CSC	
3.1.7.1.b	The DAS shall perform periodic and continuous statusing of all components that constitute DAS.	DCON-Man DMG Interface CSC,Man IF	
3.1.7.1.c	The DAS shall log all status of all components that constitute DAS.	DCON-Man Backend Main CSC	
3.1.7.1.d	The DAS shall support delogging of all collected status.	DCON-Man Delog Window CSC	
3.1.7.1.e	The DAS shall support printing of delogged status.	DCON	
3.1.7.1.f	The DAS shall indicate via an alert to the WSC TOCC when abnormalities are detected in DAS	DCON-Man DASCON Interface CSC	DCON sends status to DASCON
3.1.7.1.g	The DAS shall provide status indicators on the equipment front panels of all components that	DCON	
3.1.7.1.h	The DAS shall provide DAS Customer performance status data to the LCM	DCON-Man DMU Card Status Window CSC,	
3.1.8.1.a	The DAS shall place itself in a fully operational return data processing state in response to a system	DCON-Man GUI Main CSC	

Requirements Traceability Matrices
DCON CSCI

3.1.8.1.a	The DAS shall place itself in a fully operational return data processing state in response to a system	DCON-Man GUI Main CSC	
3.1.8.1.b	The DAS shall retain its current operational state resource allocation.	DCON-Man Backend Main CSC	
3.1.8.1.c	After a restart operations command has been issued, the DAS shall restore service to its last operational	DCON-Man GUI Main CSC	
3.1.8.1.d	The DAS shall report incremental status during the start up operations sequence to the DAS LCM.	DCON-Man Main Alert Logging CSC	
3.1.8.1.e	The DAS shall shutdown its operations in an orderly fashion in response to a system operations	DCON-Man GUI Main CSC	
3.1.8.1.f	The DAS shall report incremental status during the shut down operations sequence to the DAS	DCON-Man Main Alert Logging CSC	
3.1.9.b	The DAS implementation shall provide for modular expandability of demodulators.	DCON-Man Network Config Window CSC	
3.1.9.e	The DAS implementation shall provide for modular expandability for processing function.	DCON	
3.2.6.a	The DAS shall automatically provide status reports of all components that constitute DAS to the Local	DCON-Man GUI Main CSC	
3.2.7.1.a	DAS shall log status of all components that constitute DAS every 1 second. (TBR)	DCON-Man Backend Main CSC	
3.2.7.1.b	DAS shall time stamp all delogged status outputs.	DCON-Man Delog Window CSC	
3.2.7.1.c	DAS shall allow delogging of status based on data value changes only.	DCON-Man Delog Window CSC	
3.2.7.1.d	DAS shall log an event alert when an operational abnormality occurs within 1 second (TBR) of the	DCON-Man Main Alert Logging CSC	
3.2.7.1.e	The DAS shall provide status of all components that constitute DAS on demand.	DCON-Man GUI Main CSC, Man DASCON	
3.2.7.1.f	The DAS shall provide DAS Customer performance status data to the LCM on demand.	DCON-Man DMU Card Status Window CSC	
3.2.7.1.g	The DAS shall allow delogging of individual status measurands.	DCON-Man Delog Window CSC	
3.2.7.1.h	The DAS shall maintain system status log data for at least 45 days. (TBR)	DCON-Man Backup Database CSC	
3.3.3.a	The DAS shall exchange information with DAS Customers in accordance with the specifications in the DAS to Customer ICD. (TBD)	DCON-Man DASCON Interface CSC	DCON only interacts indirectly with the customer through the DASCON

Requirements Traceability Matrices
ICON CSCI

Specific Paragraph	Requirement	Implemented (CSCI-CSC-CSU)	Comment
3.1.2.4.2.f	The DAS shall propagate the last state vector in the existing DAS Customer ephemeris if a new state vector update is not available.	ICON - Manage IBU Direction Cosines CSC	
3.1.3.1.b	The DAS shall support the Pointing beamforming modes.	ICON - Manage IBU Control CSC	
3.1.3.1.c	The DAS shall support the Adaptive beamforming mode.	ICON -Manage IBU Control CSC	
3.1.3.1.d	The DAS shall support the Fixed Weight beamforming mode.	ICON - Manage IBU Control CSC, Fixed Weight SubFunction CSC	
3.1.3.1.f	The DAS beamformer(s) shall switch between EMC output(s).	ICON -Manage DASCON Interface CSC	
3.1.3.1.i	The DAS shall switch out any of the element channels upon request.	ICON -Manage IBUG Command CSC	
3.1.6.a	The DAS LCM shall provide an operational interface to monitor, coordinate, control and report the performance of all DAS system components.	ICON -Manage IBUG Status CSC	
3.1.6.b	The DAS shall accept system control commands from the DAS LCM.	ICON -Manage IBUG Command CSC	
3.1.6.c	The DAS shall provide system control reports to the DAS LCM.	ICON -Manage IBUG Report CSC	

Requirements Traceability Matrices
ICON CSCI

3.1.6.d	The DAS shall accept system status requests from the DAS LCM.	ICON -Manage IBUG Report CSC	
3.1.6.e	The DAS shall report system status to the DAS LCM.	ICON -Manage IBUG Interface CSC	
3.1.6.i	The DAS shall support enabling and disabling adaptive nulling from the LCM.	ICON -Manage IBUG Command CSC	
3.1.7.1.a	The DAS shall provide status of all components that constitute the DAS to the LCM.	ICON -Manage IBUG Status CSC, Manage FCRX Card Subfunction CSC, Manage IBU Card Subfunction CSC, Manage IBUG Control Processor CSC, Manage FOSwitch Status CSC, Manage FOSwitch NTS CSC, Manage FOSwitch Control Processor CSC	
3.1.7.1.b	The DAS shall perform periodic and continuous statusing of all components that constitute DAS.	ICON -Manage IBUG Status CSC, Manage FCRX Card Subfunction CSC, Manage IBU Card Subfunction CSC, Manage IBUG Control Processor CSC, Manage FOSwitch Status CSC, Manage FOSwitch NTS CSC, Manage FOSwitch Control Processor CSC	
3.1.7.1.c	The DAS shall log all status of all components that constitute DAS.	ICON -Manage Main Alert Logging CSC	

Requirements Traceability Matrices
ICON CSCI

3.1.7.1.d	The DAS shall support delogging of all collected status.	ICON -Manage Archiving CSC	
3.1.7.1.e	The DAS shall support printing of delogged status.	ICON -Manage Archiving CSC	
3.1.7.1.f	The DAS shall indicate via an alert to the WSC TOCC when abnormalities are detected in DAS operations and resources.	ICON -Manage SSC Serial Interface CSC	
3.1.7.1.g	The DAS shall provide status indicators on the equipment front panels of all components that constitute DAS.	ICON -Manage IBUG Status CSC, Manage FCRX Card Subfunction CSC, Manage IBU Card Subfunction CSC, Manage IBUG Control Processor CSC, Manage FOSwitch Status CSC, Manage FOSwitch NTS CSC, Manage FOSwitch Control Processor CSC	

Requirements Traceability Matrices
ICON CSCI

3.1.7.1.h	The DAS shall provide DAS Customer performance status data to the LCM.	ICON -Manage IBUG Status CSC, Manage FOSwitch Status CSC	
3.1.8.1.a	The DAS shall place itself in a fully operational return data processing state in response to a system startup command.	ICON -Manage Backend Main CSC	
3.1.8.1.b	The DAS shall retain its current operational state resource allocation.	ICON -Manage Archiving CSC	
3.1.8.1.c	After a restart operations command has been issued, the DAS shall restore service to its last operational state.	ICON -Manage Network Configuration CSC	
3.1.8.1.d	The DAS shall report incremental status during the start up operations sequence to the DAS LCM.	ICON -Manage Backend Main CSC	
3.1.8.1.e	The DAS shall shutdown its operations in an orderly fashion in response to a system operations termination command.	ICON -Manage Backend Main CSC	
3.1.8.1.f	The DAS shall report incremental status during the shut down operations sequence to the DAS LCM.	ICON -Manage Backend Main CSC	
3.1.8.1.g	The DAS shall detect changes in the DAS internal configuration data to automatically adjust to changes in the system resources during normal operations.	ICON -Manage DASCON Interface CSC	

Requirements Traceability Matrices
ICON CSCI

3.1.8.2.a	The DAS shall support adding and removing DAS resources from the pool of shared resources from the DAS LCM.	ICON -Manage IBUG Command CSC	
3.1.8.2.b	The DAS shall change the allocation of resources assigned to the shared pool of resources without interrupting normal DAS operations.	ICON -Manage IBUG Command CSC	
3.1.9.a	The DAS implementation shall provide for modular expandability of beamformers.	ICON -All CSCs	
3.1.9.e	The DAS implementation shall provide for modular expandability for processing function.	ICON -All CSCs	
3.2.6.a	The DAS shall automatically provide status reports of all components that constitute DAS to the Local Control Monitor with a 5 second refresh rate.	ICON -Manage IBUG Status CSC, Manage FCRX Card Subfunction CSC, Manage IBU Card Subfunction CSC, Manage IBUG Control Processor CSC, Manage FOSwitch Status CSC, Manage FOSwitch NTS CSC, Manage FOSwitch Control Processor CSC	

Requirements Traceability Matrices
ICON CSCI

3.2.7.1.a	DAS shall log status of all components that constitute DAS every 1 second. (TBR)	ICON -Manage IBUG Interface CSC, Manage FOSwitch Interface CSC	
3.2.7.1.b	DAS shall time stamp all delogged status outputs.	ICON -Manage IBUG Interface CSC, Manage FOSwitch Interface CSC	
3.2.7.1.c	DAS shall allow delogging of status based on data value changes only.	ICON - Manage Archiving CSC	
3.2.7.1.d	DAS shall log an event alert when an operational abnormality occurs within 1 second (TBR) of the occurrence of the abnormality.	ICON -Manage Main Alert Logging CSC	
3.2.7.1.e	The DAS shall provide status of all components that constitute DAS on demand.	ICON -Manage DASCON Interface CSC	
3.2.7.1.f	The DAS shall provide DAS Customer performance status data to the LCM on demand.	ICON -Manage FCRX Card Subfunction CSC, Manage IBU Card Subfunction CSC, Manage IBUG Control Processor CSC, Manage FOSwitch NTS CSC, Manage FOSwitch Control Processor CSC	

Requirements Traceability Matrices
ICON CSCI

3.2.7.1.g	The DAS shall allow delogging of individual status measurands.	ICON -Manage Archiving CSC	
3.2.7.1.h	The DAS shall maintain system status log data for at least 45 days. (TBR)	ICON -Manage Backup Database CSC	
3.3.3.a	The DAS shall exchange information with DAS Customers in accordance with the specifications in the DAS to Customer ICD. (TBD)	ICON -Manage DASCON Interface CSC	

Demand Access System (DAS)

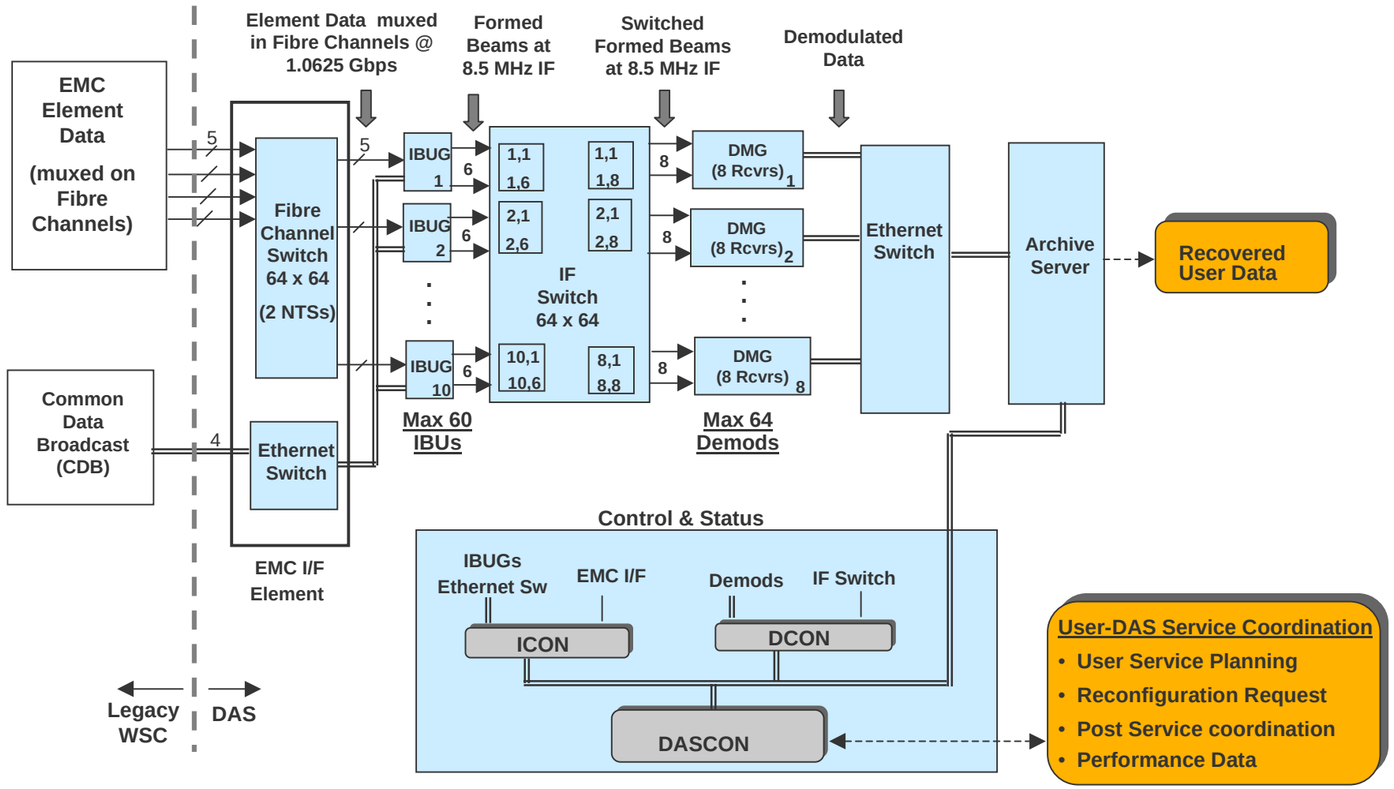
Preliminary Design Review

26 - 27 October 2000

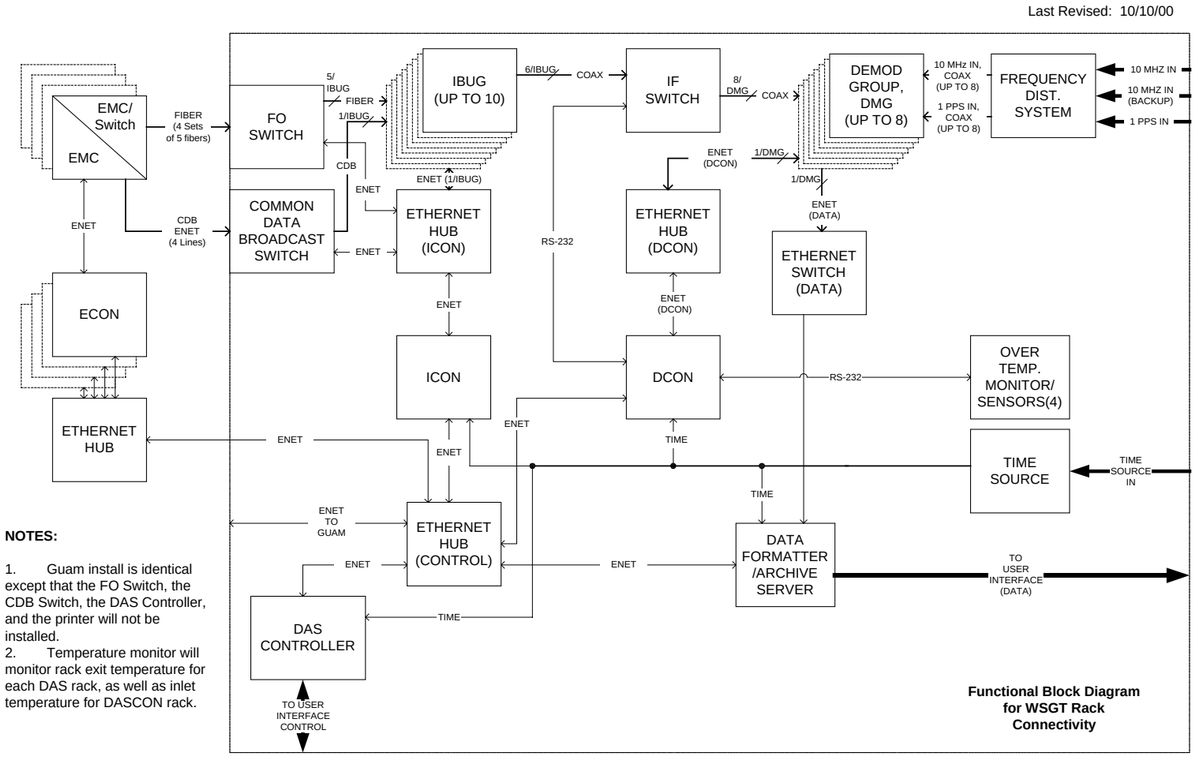
Supplemental 11x17 Drawings

“DAS – Next Generation Multiple Access Service”

‘Signal Processing’ Architecture (WSGT)



DAS System Block Diagram and Interconnects

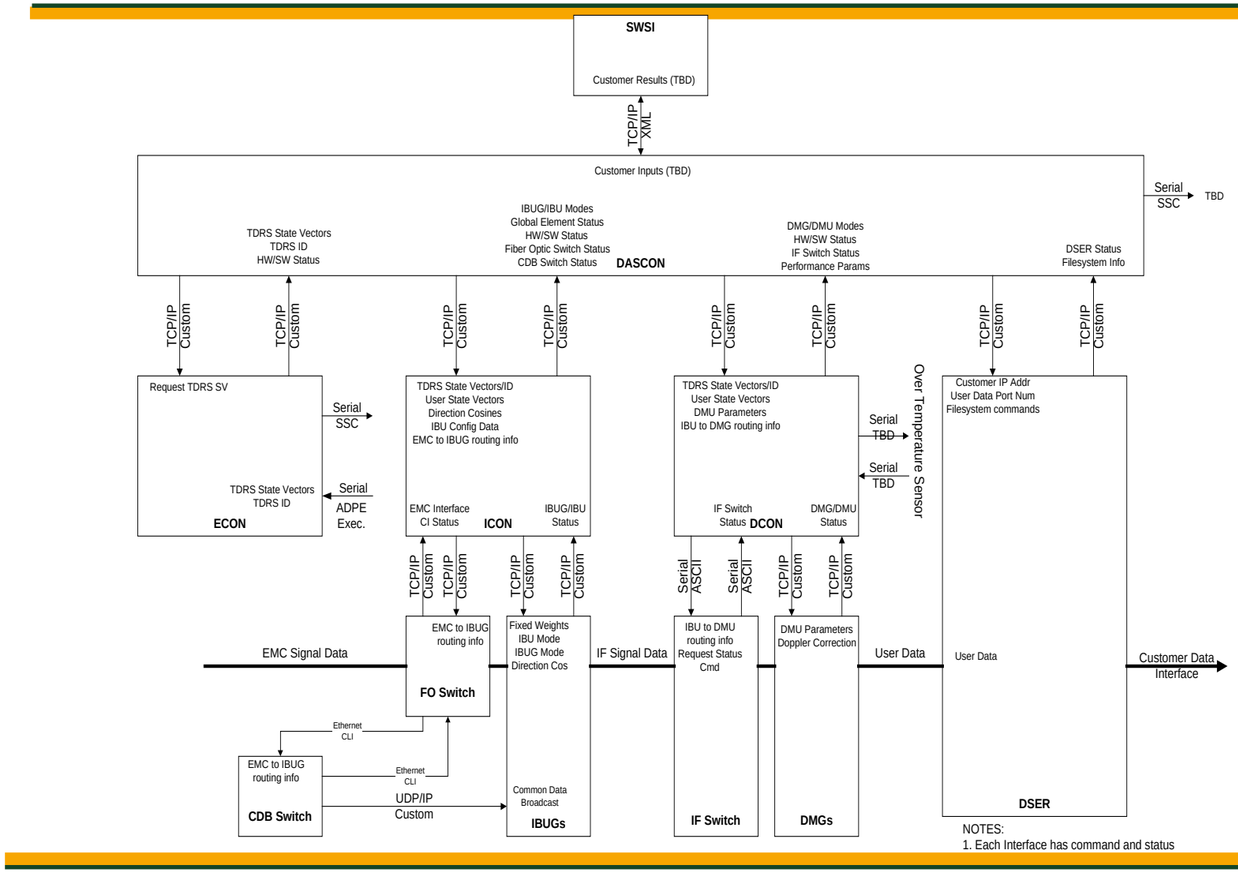


NOTES:

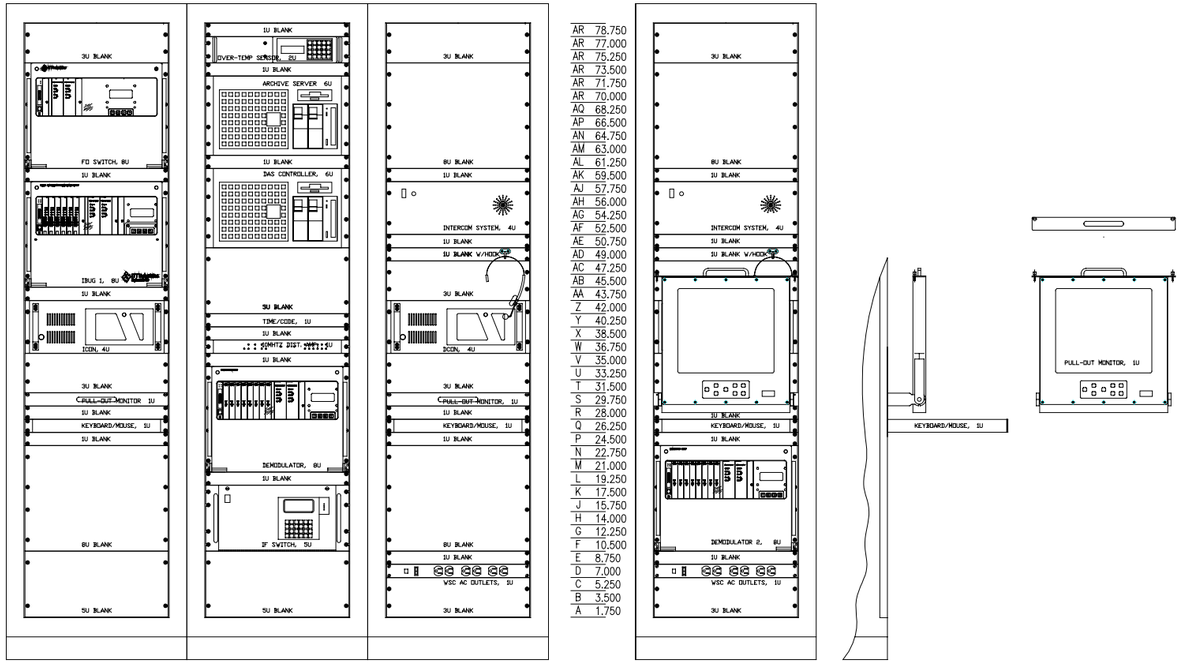
1. Guam install is identical except that the FO Switch, the CDB Switch, the DAS Controller, and the printer will not be installed.
2. Temperature monitor will monitor rack exit temperature for each DAS rack, as well as inlet temperature for DASCON rack.

J:\EVERYONE\DAS PROGRAM\PERSONAL FOLDERS\STEVE J\DASFBD101000.VSD

DAS Interface Overview



Initial Rack Install



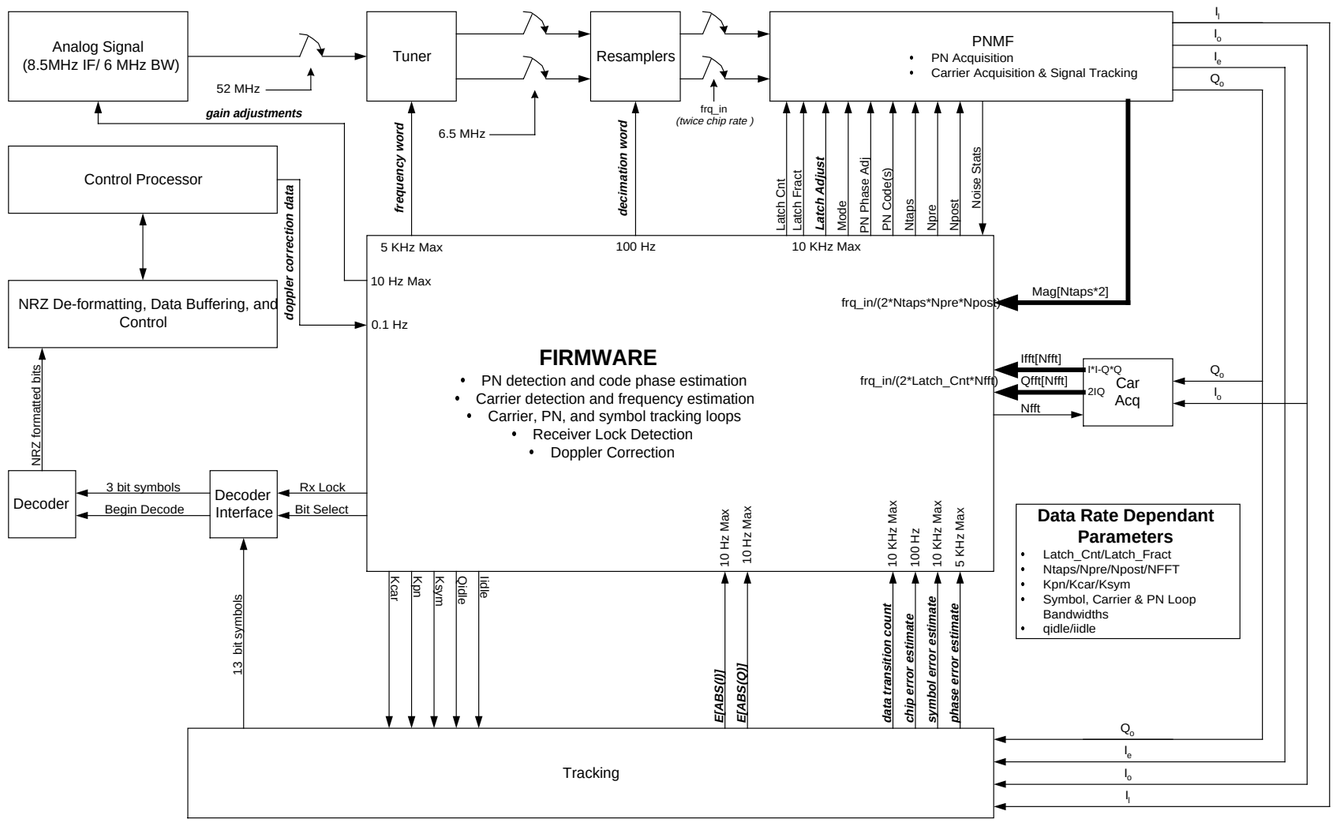
FRONT VIEW

FRONT VIEW WITH MONITOR

SIDE VIEW W/KYBD AND MONITOR

Extended Rack Install

Signal Processing Architecture



Interfaces - Block Diagram